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THE SURGICAL TREATMENT OF EMPYEMA.[1]

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IN the surgical treatment of empyema there would seem to be three problems imposed: In the acute stage, the first is to save life, the second to insure early healing and to prevent chronic cavitation and suppuration. After the acute stage, the problem, in the event of a chronic sinus persisting, is to cure it.

The infecting microbic organisms of importance are staphylococci, streptococci and pneumococci.

1. Staphylococcal empyema is practically always fatal; it is a part of a staphylococcal septicæmia or pyæmia and is due, as a rule, to an infarct lodging under the visceral pleura and rupturing into and infecting the pleural cavity; it is extremely rare.

2. Streptococcal empyema most commonly occurs in the course of an influenzal pneumonia; it is characterized by the very early infection of the pleura and a comparative slowness in walling off. It causes a high mortality, especially if the empyema is opened early before adhesions have walled off the cavity, owing to the entry of air into the pleural cavity and the occurrence of mediastinal "flop" in an embarrassed respiratory condition.

3. Pneumococcal empyema is the most common of all, and, luckily, accompanied by the lowest death rate. The empyema in this type usually occurs at about the time of the crisis, though rarely it may be earlier. It is characterized by the formation of a large amount of fibrin; as much as a teacupful may be removed at the time of operation. There is very early and firm walling off of the collection of pus.

The mortality in the first two years of life is large. The pneumonia in these cases tends to spread and persist, and there is less tendency to resolve and as a result there is considerable tendency for the formation of abscesses in the lungs and

[1] Read at a meeting of the New South Wales Branch of the British Medical Association on November 30, 1933.

bronchiectatic cavities. The lung, in consequence, has a poor expansion, so that the pleural cavity tends to remain open. Again, in these children there is always little resistance to the infection, as is shown by the lack of crisis, the tendency to spread, and the lack of resolution in the lung.

Cameron[1] has pointed out that the prognosis of empyema varies from bad to good according to the time at which the pus is found, namely, during or after the active pneumonic stage (syn-pneumonic and meta-pneumonic), and this is in the main another way of saying that the influenzal type with streptococcal infection is more fatal than the pneumococcal variety.

Death in empyema may be due to the following: (i) the severity of the general infection and of the bacteriæmia; (ii) the type of organism; (iii) the too early opening of an empyema and the mediastinal "flop"; (iv) the too late recognition of the presence and so late opening of an empyema, when death is due to toxæmia (this, however, takes some six to twelve weeks to occur); (v) the occurrence of secondary infection after the empyema has been opened and drainage established.

Secondary infection occurs mainly when open drainage is resorted to and air is sucked in and out of the tube into the infected area of pleural cavity, rendering it late in closing up; organisms may be carried in through the tube or, owing to longer persistence of the cavity, may travel along the track of the tube.

Secondary infection usually occurs about seven to ten days after the opening. It is evidenced by a rise of temperature *et cetera*, and it may be the final load to carry, which causes the death of the patient, who has been already weakened by a severe toxic infection. These are the conditions, then, that cause the first problem, namely, how to save life in an acute empyema.

What are the conditions that cause or prevent chronic cavitation and suppuration? The thorax is a rigid-walled cage enclosed by ribs and muscles, and in empyema there is collapsed lung, generally more or less infiltrated by an inflammatory tissue and not yet fully resolved and so not capable of expansion. Between this and the chest wall is a cavity containing pus generally with a large amount of fibrin, some of which is deposited on both parietal and visceral layers of the pleura; the floor of the cavity is the depressed portion of the diaphragm. As the bony wall cannot collapse, the cavity must heal by the diaphragm being raised somewhat and by expansion of the lung until the visceral meets the parietal pleura.

This healing of the cavity and the expansion of the lung may be prevented by: (i) lack of resolution of the pneumonia and the transformation of the inflammatory infiltration into fibrous tissue; (ii) the fibrin of the visceral layer may organize and become vitalized and form a thick fibrous envelope that will prevent the expansion; (iii) a lung abscess may form and open into both bronchial and pleural cavities.

Acute Empyema.

The guiding principles in treatment are (i) to wait until the cavity is walled off, then (ii) to provide for expansion of the lung by closed drainage.

When is the cavity walled off? Hippocrates laid down that an empyema should be opened on the fifteenth day after the onset of the illness, and there does not seem much room for improvement on that as a dictum. A generation ago they were accustomed to wait until the pus was thick and creamy, calling it "laudable pus", and this too cannot be improved upon in this condition.

If the pus is very thin and fluid there is a risk that it is not properly walled off, and it is better to wait until it thickens, and one can be sure of localization at its edges where the cavity is shut off. If the fluid is profuse, it can be aspirated at this stage, and if it re-accumulates quickly, re-aspiration done until it is of the desired consistency; this is most necessary in streptococcal infection. Aspiration alone will in some cases of low virulence cure the condition; but it is not reliable and generally leaves the pleura greatly thickened.

The site of the opening into the chest when the collection of fluid is large should be at the eighth or ninth rib in the post-axillary line, care being taken to see that it is well below the level of the excursion of the angle of the scapula. Should the collection be local or that of an interlobar empyema, the incision should be made over the site of the exploratory needle puncture. If the rib is to be excised about 3·75 to 5·0 centimetres (one and a half to two inches) of rib should be removed subperiosteally, and in each case the exploratory needle should be again inserted before the parietal pleura is opened, and when pus is found, the sinus forceps should be passed along the needle until the cavity is freely opened. Fraser[2] opens in between the ribs and does not excise any portion of the rib. If open drainage is to be relied on, a drainage tube 1·9 centimetres (three-quarters of an inch) in diameter is inserted and stitched in position; if closed drainage is used, the parietal pleura is separated from the thoracic cage for about 1·75 centimetres (half an inch) all round, so as to leave it free for stitching afterwards. The edges of the incision are then widely retracted and all fibrin is removed; particularly in pneumococcal cases, the amount of fibrin present is surprising. It may be removed with large swab forceps, or strips of gauze in which to entangle the fibrin may be inserted. The finger is then passed into the cavity and the point noted that would be the most dependent if the child were sitting fairly upright; a stab incision is then made at the point of the finger through the muscles of the chest wall. A drainage tube, six millimetres (one-quarter of an inch) in diameter, is now inserted so that its cut end lies just within the pleural cavity; it is stitched in position, or, as Fraser suggests, passed through a large cork of the pickle-bottle size, which is applied closely to the thoracic wall and then plastered over freely with strapping so as to keep it airtight. The first wound

is then sutured in layers. It will generally be found to heal by first intention.

If the fibrin is not freely removed it will take time to break down and be expelled as pus, and some of it will organize and cause fibrous thickening on the lung or even a diaphragm across the cavity, and interfere with free drainage.

In whatever way the small tube is fixed in position it must be made absolutely airtight by sealing off its entry into the chest. This may usually be effected by means of adhesive plaster or a considerable amount of cotton wool impregnated with collodion. The end of the tube is brought under some water or some antiseptic fluid in a bottle attached to the bed. Each breath and cough will cause pus to be forced into the tube and into the bottle, and its place will be taken by expanded lung. In this way, too, will the air that is admitted into the cavity during the time of operation be expelled. When all the fibrin has been carefully removed and the drainage tube kept airtight, the cavity will heal in many cases within a fortnight. This is roughly Fraser's method, and is the one that has proved most satisfactory in my hands.

McEachern,[3] of Winnipeg, has evolved a form of operation that has proved most satisfactory in his hands.

He carries out the operation under local anæsthesia, inserts a catheter (size "16" or "18" French) through a trocar between the ribs, and withdraws the trocar. The opening round the catheter is then sealed by the application of separate layers of wool and gauze saturated with collodion, until a collar is built up around the tube, making it 12·5 centimetres (five inches) in diameter and about 1·25 centimetres (half an inch) thick. This dressing is then fanned for half an hour before the patient leaves the table, when the collodion is sufficiently firm to allow the child to move without causing damage to the dressing. A clamp is then fitted to the end of the catheter for four hours, when it is removed and the irrigation and drainage apparatus connected. Irrigation of the cavity is done every few hours during the day and two or three times in the night.

The Carrel-Dakin container is never allowed to be more than 48 centimetres (18 inches) above the opening in the chest. To irrigate, the clamp is removed from the tube leading into the Dakin's flask and the solution allowed to run into the chest until it causes pain or stops running; this clamp is then replaced and the clamp of the drainage tube loosened to allow the solution to drain off. If the catheter becomes blocked with fibrin, it is cleaned by injecting saline solution.

In McEachern's hands the mortality, particularly in young babies, has diminished considerably by this method of treatment.

I have never liked the instillation of the Carrel-Dakin fluid and have my doubts as to its efficiency in the dissolving of fibrin, and I think that the efficacy of McEachern's method is that it allows expansion of the lung to occur. It is a closed method and prevents the ingress of air into the cavity and its secondary infection.

In the open methods secondary infection invariably occurs, and then, instead of two pleural layers adhering as they come together, there will, in addition to the toxic infection, be some ulceration of the pleura, and the cavity will be compelled to heal by granulation; so additional time will be needed and thicker scar tissue will form between lung and chest wall.

The closed method of drainage and the free removal of fibrin should be our best method of prevention of the chronic sinus condition, which may happen in spite of our efforts should the pneumonic consolidation fail to resolve and should the lung become inelastic from fibrous infiltration and should abscess or bronchiectasis occur.

Other features in keeping up a sinus are necrosis of the rib, part of which has been excised; a foreign body in the cavity, such as a drainage tube, and, as I saw in one case, gangrene of the lungs.

This patient was one sent in as suffering from chronic unhealed empyema cavity that had been treated elsewhere. It was of some three to four years' duration, and there was still copious discharge. Free removal of the ribs overlying the cavity was done. The cavity was found to be filled with tissue that one could still recognize as gangrenous lung with the naked eye. When this piece of lung, which was quite free in the cavity, was removed, openings of at least eight to ten bronchioles were seen in the lung tissue from which it had separated, and the tissue in between the bronchioles was completely epithelialized. With the bronchi opening in this cavity, it was, of course, impossible to allow it to heal up, so a plastic operation was done by transplanting skin flaps to line the edge of the cavity so as to leave a depression into which the bronchial discharge could be passed.

Should, for some reason, an unhealed cavity remain, one has to decide how long operative intervention should be delayed. In some cases such cavities heal by filling up with granulations after many months. There is a general collapse of the chest on the affected side, and it is held by fibrous tissue to the lung, and cannot stretch this tissue in respiration, and a lateral curvature will frequently result.

Late Closure of the Cavities.

If there is any sign of flattening of the chest or marked resistance of movement, operation should be done. This is best done by removing all the bone overlying the cavity and a little beyond, and by stripping up a muscle and skin flap. The most important point is to decorticate all the lung beneath, so as to allow for its expansion; this done carefully and completely the muscle flap is allowed to drop back on it and so obliterate the cavity.

Anæsthesia.

A general anæsthetic is to be preferred for children, owing to their irritability and excitability on the table; but if the condition is very poor, a local anæsthetic may have to be used, and occasionally in very debilitated children it is the only possible one. For children, ethylene is the most satisfactory anæsthetic. In the old days of chloroform anæsthesia death on the table was not infrequent in empyema, the toxic myocardium giving way under the chloroform poisoning.

If the patient is very debilitated and toxæmic, an opening may be made in an interspace and a tube inserted.

Bilateral Empyema.

Patients with bilateral empyema, if the cavities are well walled off, may have both sides done at one sitting without any undue risk. Sometimes, however, it will be found that the pus on one side is thick and on the other thin, in which case the side with the thicker pus should be opened first, aspiration done on the other and thickening up and walling off awaited. Occasionally there is found an empyema due to a hydatid that has suppurated and caused pneumonia; in most of these cases the hydatid is free in the empyema cavity and causes no difficulty.

I cannot believe that the use of Wolff's bottles does any good; the principles on which they are used are not such as to allow expansion of the lung.

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THE TREATMENT OF EMPYEMA.[1]

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DISSATISFIED with the long convalescence in most cases of empyema, and the frequency of chronic empyema, necessitating a severe operation, I have for many years given close attention to this subject in the hope of improving the results.

During the Great War, and in the years immediately following, a great deal was written on empyema, much of the discussion ranging round the best site for thoracotomy and the relative methods of aspiration and thoracotomy. The most illuminating article was that of the Empyema Commission in the United States of America, which was formed as the result of the alarming mortality in the troops mobilized in the Great War. The findings of this commission have done much to clarify the pathology of the disease and to place treatment on a sound basis. English surgeons and physicians, such as Tudor Edwards and Young, have also done excellent work in recent years. To Dr. Rex Money, on his return from England, where he had seen modern chest work, I owe the suggestion to use Potain's aspirator in order to obtain good suction drainage; he also brought under my notice the improvement in the Tudor Edwards tube. These appliances I consider a decided improvement; otherwise my views are those that I have held and practised for the last thirteen years or so, since the report of the United States of America Empyema Commission.

It is unavoidable that in the attempt to improve treatment, one occasionally wanders from the path and is tempted to try methods that have not been proved to be justified and have been later abandoned; but, even so, I consider that this is better than to have been content with the older methods of treatment and with prolonged convalescence following their use.

The principles which govern successful treatment are: (i) the evacuation of the pus; (ii) the maintenance, as far as possible, of the negative pressure within the pleural cavity; (iii) the control of the pleural infection.

Perhaps before dealing with these, one should emphasize that the bacteriology of the pleural infection is the deciding factor in methods of treatment. When the chest is aspirated and pus is obtained, the first person to be consulted is the bacteriologist and not the surgeon. If thin pus and streptococci are obtained, then caution is necessary, because the pleural infection in these cases is coincident with an infection of the lung, possibly both lungs, and of the nature of broncho-pneumonia. On the other hand, if pneumococci are obtained, and the pus is thick and creamy, then the patient has recovered from the acute stage of the infection, although he probably still has, in most cases, some consolidation in part of one lung. Of course, it is not infrequent for mixed infection to be present, sometimes some of the organisms being gas-forming, and so we have pyo-pneumothorax. In streptococcal cases, not only is there coincident pulmonary infection, but there is also an absence of adhesions between the visceral and parietal pleuræ; this is a feature of these empyemata. A study of the physics of the chest wall will well repay attention here.

The Physics of the Chest.

In the pleural cavity alone, of all the regions of the body, is there a consistent negative pressure. This is by far the most important consideration in dealing with the thorax, since it means that unless very special precautions are taken in opening into the pleural cavity, the opening will generally be followed by the immediate collapse of the lung on that side. This negative pressure may be as much as 30 millimetres of mercury in deep inspiration, but on closing the glottis and coughing, it may be converted into a positive pressure of 100 millimetres or more (Souttar). When one side of the chest is opened, the conditions on the two sides become entirely different. If the opening is large, the viscera on this side are subject simply to atmospheric pressure, whilst on the other side they are subject to pressures that vary from *minus* 30 millimetres to *plus* 100 millimetres. If the two sides were separated by a rigid partition, no great harm might result; they are, however, separated by a very mobile mediastinum (containing heart, large vessels, and a mass of important nervous structures). These variations in pressure will throw the mediastinum from side to side, producing the condition known as "flapping of the mediastinum". The dangers of this need not be stressed; yet it is the immediate result of a large opening made in the

[1] Read at a meeting of the New South Wales Branch of the British Medical Association on November 30, 1933.

chest without due precaution. The recognition of this, and the elaboration of means to avoid it, form an important advance in modern surgery.

Thomson, of Bath, has some very interesting remarks on the physics of the chest, which have a close bearing on the treatment of empyema. Quoting Graham, of the United States of America Empyema Commission, he points out that the compression induced in one lung by injection of air into the pleura on that side is accurately reflected in the compression induced in the lung on the opposite side. If, at each effort of inspiration, air is sucked into the pleural cavity by way of a large open drainage tube at the same time as it is sucked into the lung by way of the trachea, the amount of air that enters the thorax by these two routes respectively, is governed entirely by the resistance offered by the trachea and bronchial tubes on the one hand, and by the open drainage tube on the other. Further, as we must regard the thorax as a single cavity, and not as two separate cavities, it is possible by increasing the size of the opening in the chest wall to produce a condition in which all the air enters into the pleura and none of it into the lung; in other words, to produce asphyxia and immediate death. This was what happened in many cases in the Great War.

Graham worked out with mathematical precision that the largest opening compatible with life in a healthy adult is about five by ten centimetres (two by four inches). In a patient suffering from empyema, however, the additional embarrassment of respiration produced by an open pneumothorax is a much more serious matter. One lung at least is partly thrown out of action by the consolidation, and in streptococcal broncho-pneumonia both lungs are involved, so that an open resection followed by the introduction of a large drainage tube in a patient desperately ill may easily turn the scale.

Now to return to the clinical aspect.

Evacuation of the Pus.

For a while, aspiration alone had a great vogue; but although there is no doubt that it appears to be sufficient sometimes in the treatment of empyema of children, and occasionally in the dispersal of a small collection in an adult, still I think there has been a little reaction from over-dependence upon it.

Bloodgood, in a recent article, I understand, advocates the injection of streptococcal antiserum into the cavity in streptococcal cases; but of this I have no experience. In most cases, thoracotomy is necessary. But in streptococcal cases, owing to the absence of adhesions and the presence of pulmonary infection, it is wise to aspirate on several occasions for two or three weeks; then, when the pus is thicker, to do a thoracotomy (by this time adhesions will have formed). I saw one case when thoracotomy was delayed for four weeks; as a result, adhesions had so successfully formed that loculation was present, and a second thoracotomy had to be done to drain the loculated portion. This was done a week after the first operation.

There are some who think that the failure to evacuate the fibrinous masses in the pus is an important cause of the chronicity of the disease. I think it is only one of the many causes.

The old method of thoracotomy was to put an ordinary rubber drainage tube into the pleural cavity and out into the dressings. Mixed infection very quickly took place (this I have proved bacteriologically); the pleura was subject to ordinary atmospheric pressure, and the lung was prevented from expanding, and chronic empyema was a frequent result. It is known as the method of "open drainage".

The next stage was the replacing of the ordinary drainage tube by a double flanged short Pollard tube. This had the advantage of not projecting into the pleural cavity to an unnecessary degree; but it had the disadvantage that the flanges were only vulcanized on, and occasionally the flange became detached into the pleural cavity; this, of course, could have been avoided by making them of one-piece rubber.

The next step in the treatment was the introduction of "closed drainage", in which the empyema tube was connected to tubing leading into a closed bottle containing some lotion. Following this came the Tudor Edwards tube, in which the instillation of an antiseptic lotion, such as Dakin's solution, was combined with closed drainage. The latest Tudor Edwards tube has a flange to fit against the skin of the chest wall as well as an inner one to fit snugly against the parietal pleura. The outer flange helps to cover the wound, and also allows the fixation of the tube by sutures without penetration of the lumen of the tube.

Closed drainage by gravity (the large bottle into which the pus was conveyed being placed on the floor at the bedside) was used for some time; but the recent introduction of suction drainage by means of Potain's aspirator is a decided improvement. There are a few points in this that need close attention. A large bottle with a wide neck is desirable; the glass is preferably clear to enable the nurse to report on the daily diminution or otherwise of the pus. A rubber cork is desirable; the glass tubes penetrating it should fit very snugly. The glass tube, with a lumen of nine millimetres (three-eighths of an inch), conveying the pus *et cetera*, from the chest, should, of course, be long enough to reach the lotion at the bottom of the bottle; the other one, leading to the Potain aspirator for suction purposes, is, of course, short. Preferably they should curve away from the bottle rather than be bent at an angle. The bottle has no need to be on the floor; it can be on a small table just below the level of the bed. The Potain aspirator is excellent when in order. It is most desirable that occasionally it should be disconnected and oiled; otherwise the pellets of shot adhere and do not fall into their places, and the syringe fails to work. This is a simple procedure and only takes a few minutes.

The site of the thoracotomy wound has always been the subject of much debate. It is controlled by two factors. If we are merely employing drainage without the addition of the Carrel-Dakin treatment, then the opening may be opposite roughly the deepest part of the cavity, and at that place which will be reached last by the expanding lung. Opening at the most dependent part of the cavity does not apply to empyema. The lowest and the highest points will be those where the lung, on expanding,

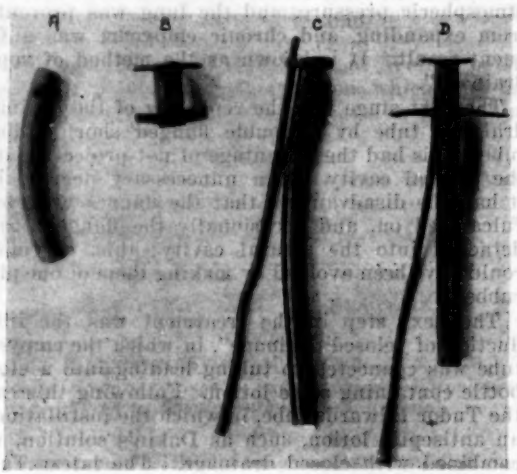

FIGURE I.
A = Ordinary drainage tubing. B = Pollard's tube. C = Tudor Edwards's tube. D = Improved Tudor Edwards's tube.

will first touch the chest wall; when that happens, drainage from these points must be embarrassed. The same thing applies when the opening is too far back or too far forward. Generally the seventh rib in front of the posterior axillary line is looked upon as the best rib to resect. If one has faith in the Carrel-Dakin treatment, then I think it is wise to ascertain by means of the exploratory needle the highest level of the pus, and resect in that situation.

The Maintenance of the Negative Pressure.

Maintenance of the negative pressure is attempted by attention to the following points:

1. The operation is done quickly, putting a few interrupted stitches in the muscle round the tube and some interrupted stitches in the skin.

2. The Tudor Edwards tube is clamped until the patient returns to the ward, when it is connected to the bottle. It is essential to see beforehand that this connexion is airtight; if not, the whole method will break down. Imperfectly fitting rubber and glass tubing are not unknown even in the best hospitals. The dressing is to be snugly fitted over the wound and round the tube. A square of thin rubber with a slit in the centre to enable it to be put over the drainage tube and over the dressing, is then placed on the chest wall and fixed with "ZO" strapping. Portion of an old rubber glove is suitable for this purpose. In order to make the thoracotomy wound airtight, McEachern, of Winnipeg, is in the habit of applying collodion to it. I did this on one occasion, and prevented the air from getting into the pleura from without; I also prevented the pleural pus, which had got into the muscle layers from round the tube, from gaining an outlet externally. The patient developed fatal cellulitis of the chest wall and back. I have since abandoned the procedure.

3. I would advocate using the Potain syringe every two hours to create a negative pressure in the bottle, and thus in the pleural cavity to which it is connected. After the temperature has subsided (say, five or six days) I think it is a wise thing to encourage the use of Wolff's bottles, or, by children, the blowing of balloons. Hunter, of King's College Hospital, writing recently in THE MEDICAL JOURNAL OF AUSTRALIA, says: "These methods do good, not so much by direct expansion of the lung, but by making the patient use the intercostal muscles on the affected side."

Control of Pleural Infection.

I am of the opinion that the length of the convalescence can be shortened by the instillation of a suitable antiseptic, such as Dakin's solution, to control the infection. I think an infected pleural cavity is a good situation for the Carrel-Dakin treatment. I do not think there are very many occasions in civil surgery in which it is worth while; the same result can be obtained by dependent drainage with much less trouble, for we must remember

FIGURE II.
A = Sheet rubber covering the dressing. B = Improved Tudor Edwards's tube. C = Metal syringe for injecting Dakin's solution. D = Bottle for suction drainage. E = Potain's aspirator.

that an essential of the Carrel-Dakin method is that the wound is a cavity in which the Dakin's solution forms a pool that is renewed from time to time. It is quite wrong to speak of a treatment that does not provide these conditions as the Carrel-

Dakin treatment: it cannot be combined with dependent drainage; the two are antagonistic.

There is one other point which may possibly vitiate the method; that is, failure to use the lotions of the correct strength (namely, 0·4% to 0·5% sodium hypochlorite solution), either through the surgeon diluting it, or more often perhaps through a fault of the dispensary; this again can often be traced back to the wholesale druggist who provides the chloride of lime of a variable strength. The chlorine content needs to be checked from time to time. Just lately, not satisfied that some septic wounds in my wards at the Sydney Hospital were progressing as satisfactorily as they should, I had an analysis of the Dakin solution made by Dr. Wardlaw of the biochemical department of the hospital; he found it one-third strength. The dispenser suggests that the manufacture of it in concrete tubs may be the factor, through the absorption of chlorine; in future, it will be made in glass containers. Of the correct cause I am not competent to speak; but of the effect I am.

Dr. Wardlaw's analyses for me have shown "Calsol", a proprietary preparation, to be very constant and accurate in its strength.

Because of my belief in the method, I prefer to make the opening into the pleura at the upper part of the collection of pus, ascertained previously by the insertion of an exploring syringe.

With regard to the combined use of Dakin's irrigation and suction drainage, it is obvious that to obtain the antiseptic effects of the Dakin solution, one cannot have too frequent suction drainage; one must compromise. I advocate in the first four or five days, irrigation every two hours during the day, applying the suction at the end of each period of two hours to withdraw the mixture of pus and antiseptic, applying the suction drainage alone by night. After that period, I recommend a less frequent use of the lotion, relying upon the suction only. As a rule, the cavity will hold 150 to 240 cubic centimetres (five to eight fluid ounces) of lotion for the first few days; the amount will diminish as the lung expands. Pain will indicate that the limit has been reached. Inject too little rather than too much. I recommend the use of a metal ear syringe; it holds nearly 120 cubic centimetres (four fluid ounces). As the pus in the bottle is reduced to a small amount, and the capacity of the empyema cavity is reduced to 30 cubic centimetres (one fluid ounce) or less, so the Tudor Edwards tube may be replaced by the intermittent insertion of a Jacques catheter with the injection of some Dakin's solution, relying upon the expansion of the lung gradually to obliterate the cavity. There is no question that in all surgical wounds a drainage tube may be left too long, acting the part of a foreign body.

When there were no complications, I used to get the wound healed in five weeks. With the introduction of suction drainage, I think this can be cut down still further.

If a bronchial fistula is present, you suspend both suction drainage and irrigation.

Intelligent and keen nursing is an important factor. I notice differences in different wards. I do not think the patient should be nursed out of doors for the first week or ten days. He demands too close attention.

Anæsthesia.

Local anæsthesia is mostly favoured, with some pre-medication. I often find it a great advantage to give a small amount of ether for the excision of the rib and the exploration of the pleural cavity to break down loculation; but this should be light. Coughing is favoured in order to expel the fibrinous masses that are present in the pneumococcal cases.

Chronic Empyema.

In the majority of cases in which the empyema has become chronic, it is due either to an unsuitably placed thoracotomy or to lack of control of the infection. The infection has become chronic, resulting in a fibrous thickening of the visceral pleura, and the prevention of expansion of the lung. Sometimes a foreign body, such as a piece of drainage tube or swab, may be the cause.

The injection of "Lipiodol" will help to outline the cavity. I do not think very extensive operations are either desirable or necessary. The removal of the portions of ribs which overlie the cavity, followed by the insertion of a dependent drainage tube, is usually all that is necessary. Of course, in all cases fresh air, particularly a change to a mountainous district, where respiration is stimulated, is indicated.

Tuberculous Empyema.

In tuberculous empyema, if purulent effusion occurs, the mortality is high as compared with those in which the effusion is serous. These purulent effusions should not be treated by open drainage, for fear of the risk of mixed infections; they should be aspirated only. Pus that is sterile is usually tuberculous.

Summary.

This article is a plea for:

1. Deliberation in the treatment of empyema; too hasty treatment may prove fatal.

2. The adoption of "closed drainage", as opposed to "open drainage".

3. The use of that variety of "closed drainage" known as "suction drainage", which I consider an improvement.

4. Close attention to detail in the arrangement and choice of tubing, bottle, cork *et cetera*, to insure that the "closed drainage" is really "closed" and not half "closed" and half "open".

5. The use of the improved one-piece Tudor Edwards tube (double-flanged); through this Dakin's solution is injected intermittently into the pleura.

OBSERVATIONS UPON THE NATURE, RATE OF GROWTH AND OPERABILITY OF THE INTRACRANIAL TUMOURS DERIVED FROM 135 PATIENTS.

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DURING the last two years the cerebral tumours derived from 135 patients have been examined by me in the Baker Institute of Medical Research and in the Pathological Laboratory of the University of Melbourne. All of these have been subjected to a fairly rigorous histological examination and, with the assistance of the modern methods of metallic impregnation, the majority have been classified. Most of the specimens were obtained at autopsy, and were therefore available for the freest examination; the others were secured at operation.

Unless sufficient of a tumour was obtained to make an unequivocal diagnosis, the tumour was not included. This precaution is rendered necessary owing to the marked astrocytic reaction which may occur at the margins of many tumours. A piece may be excised at operation, and a confident diagnosis of astrocytoma be given, whereas a fuller examination would have revealed a central nodule of growth of a different structure.

Although the number of examples examined is not great, it can be seen that the proportions of the various types occurring in Australia do not differ markedly from those found elsewhere. There are, however, several small discrepancies which will be commented on during the course of this paper.

The clinical histories were available of the majority of the cases from which these tumours were derived. The clinical course of the various tumour types will be analysed as the paper develops, and a comparison made with the course of similar types as reported elsewhere. Finally, an attempt will be made to give some general idea of the operability of all the cerebral tumours contained in the series, and certain deductions will be drawn as to the clinical indications which assist in the discrimination between the operable and the inoperable tumour.

Table I shows the relative proportion of the various tumour types encountered; the very large series of tumours examined in the Cushing Clinic must form a standard of comparison for smaller series such as this.[1]

It will be observed that the tumours of the glioma group form a higher proportion in this series than in Cushing's. This is in part due to the much lower proportion of pituitary tumours, which to some extent may be explained by Cushing's great interest in this subject. Where he finds a percentage of

TABLE I.

Showing the numbers of tumours occurring in the various groups. The percentage incidence is given and contrasted with the percentage incidence of the Cushing series.

Tumour.	The Author's Series.		Cushing's Series.
	Numbers.	Percentages of all Tumours.	Percentages of all Tumours.
Gliomata	84	62·2	42·6
Pituitary adenomata	3	2·2	17·8
Meningiomata	15	11·1	13·4
Acoustic tumours	8	5·9	8·7
Congenital tumours	2	1·5	5·6
Metastatic and invasive	19	14·1	4·2
Granulomatous tumours	Nil	Nil	2·2
Blood vessel tumours	Nil	Nil	2·0
Primary sarcoma	Nil	Nil	0·7
Papilloma of choroid plexus	Nil	Nil	0·6
Miscellaneous	4	3·0	2·2
Total	135		

pituitary tumours of 17·8, we find only 2·2%. It can hardly be claimed in Australia that one in every five cerebral tumours encountered is of the pituitary type. In addition, 5·6% of Cushing's tumours were of the nature of congenital tumours, of which only 2 or 1·5% occur in this series.

On the other hand, our incidence of secondary carcinoma is extraordinarily high. Cushing gives an incidence of only 4·2% for all metastatic tumours, whereas ours is 14·1%. This percentage would be even higher if one could include certain non-gliomatous tumours suspected of being carcinomata, but the appearances of which were atypical and could not be interpreted by reason of the incompleteness of the autopsies. When one recalls that these secondary carcinomata were usually considered to be primary brain tumours, the startling incidence of latent carcinoma is apparent. It is interesting to note that in a paper recently published by Rudershausen[2] from the Pathological Institute at Heidelberg, 102 examples of metastatic deposits were found in a series of 546 cases examined over a period of 77 years; an even higher incidence than in the present series.

The decline in the incidence of granulomatous masses is remarkable. Sir William Gowers, writing in 1892,[3] stated that over 50% of intracranial tumours were tuberculomata; Cushing gives the incidence of tuberculomata and syphilomata together as 2·2%. No granulomata occurred in this series; whenever a clinical diagnosis of tuberculoma or gumma was made, it was found to be incorrect. This decline is almost certainly due to the greatly lowered incidence of tuberculous infections, and to the more efficient prophylactic and hygienic conditions of the present day. The rarity of the large intracranial gumma is probably due to the more efficient methods of modern antisyphilitic treatment, and to the great advantages in diagnosis and control of treatment offered by modern serology.

It will be seen that the various glioma types appear to be in a somewhat different proportion to that of the Cushing series (Table II). The *glioblastoma multiforme* forms easily the largest single

TABLE II.

Showing the numbers of gliomata of each class examined. The percentage incidence is given and contrasted with the percentage incidence of Cushing's series of 1926

Tumour.	The Author's Series.		Bailey-Cushing Series of 1926. Percentages.
	Number of Patients.	Percentages.	
Glioblastomata	27	32·2	31·6
Astrocytomata	20	23·8	34·75
Astroblastomata	2	2·4	4·74
Medulloblastomata	9	10·7	12·9
Ependymomata *et cetera*	6	7·2	4·4
Oligodendrogliomata	2	2·4	3·47
Polar spongioblastomata ..	3	3·5	2·8
Pinealomata	3	3·5	2·17
Medullo-epithelioma	1?	1·2	0·63
Unclassified	10	11·9	
Retinal glioma	1	1·2	
Total	84		

group, 27 examples occurring, a proportion of 32·2% of the gliomata as compared with 31·6% in the Cushing series.

The astrocytomata, however, form only 23·8%, in contrast to 34·7% given by Cushing; 50% given by Sachs,[4] and 50% by Boyd.[5] In one paper, Cushing[6] makes a very significant note on the protoplasmic astrocytomata of the cerebrum. "Many of the latter", he writes, "are rapidly growing tumours with abundant mitoses, and should in all probability be separately classified. They moreover occur in patients with the average age of 40 years." As 87 of 151 cerebral astrocytomata were of this type, it is probable that his figures should be considerably lower. No examples of rapidly growing tumours with mitotic figures are included in the astrocytoma group in this series; some are included with the glioblastomata, others with the highly cellular unclassified gliomata.

Carmichael,[7] in England, found an even lower proportion of astrocytomata, these forming only 10% of the gliomata in his series.

The less common types were represented here in a proportion comparable to the American incidence, while the incidence of the fibro-blastomata was also very similar.

No example of true sarcoma of the brain was encountered. Our experience has been that this diagnosis is rarely tenable, where a complete and systematic search has been made for a focus of primary carcinoma. Most of the types described originally as gliosarcoma have been shown to belong to the glioma group.

The Glioma Group.

We are indebted to the Bailey-Cushing classification of 1926[8] for many of the names employed in describing gliomata. In the original classification each name was chosen from some stage in the histogenesis of the cell elements of the central nervous system, the result being the identification of 14 tumour types. Later it was found convenient to eliminate certain of the group names which indicated minor differences in histology, ten names only being retained for ordinary use.[9] In the first classification the phenomenon of anaplasia received but scanty attention; the introduction of this conception sounds the death knell of any classification based entirely on the appearances of embryogenesis. So the name *glioblastoma multiforme* has been substituted by Bailey and Cushing themselves for the name *spongioblastoma multiforme*. At the same time, it is by no means evident that names of embryogenetic significance really represent the cell types of certain of the other tumours. As, however, the pathological description of the types is fairly clear, it is convenient to retain them.

It must be admitted that many of the names at present in use are likely to be modified in the future. French authors in particular, although accepting much of the nomenclature of Bailey and Cushing, employ names based on their own conceptions of the morphology of the tumours and the anaplasia of tumour cells, but do not accept all the names based on the appearances of embryogenesis.

It will be pointed out briefly in the course of this paper which of these names seem inappropriate. I have also discussed the question more fully in a paper at present in the press.[10]

The Glioblastoma Multiforme.

The *glioblastoma multiforme* has been recognized for many years under the heading of gliosarcoma. Where the neoplastic cells were clustered about the vascular channels, other names, such as perithelioma, have in the past been employed under a mistaken belief as to their origin and nature.

The glioblastomata constitute the majority of rapidly growing, soft, infiltrating tumours of brain tissue. They show a marked predilection for the cerebral hemispheres of adult life. These features (Figures IA and IB) are exemplified by the twenty-seven examples of the present series. All occurred in

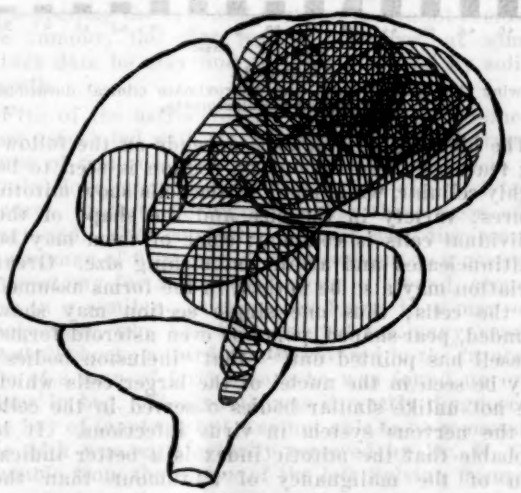

FIGURE IA.
Showing the approximate locations and sizes of certain of the glioblastomata.

adults; in only two was the brain stem involved, and in one it was by no means certain that the tumour had originated there. The rapidity of their

growth is further demonstrated by the history of those cases in which the period from the first ascertainable symptom to the death of the patient was determined; the shortest survival period was but

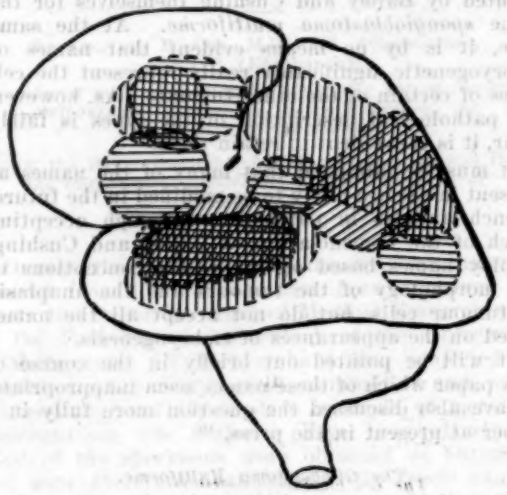

FIGURE I.
Showing the approximate locations and sizes of certain of the glioblastomata.

one month, and the longest one year (Figure II). It must be noted, however, that the survival period in Cushing's cases was considerably greater than this, averaging thirteen months. The youngest subject in my series was aged 26 years, and the eldest 60, the majority of cases occurring in the fifth decade.

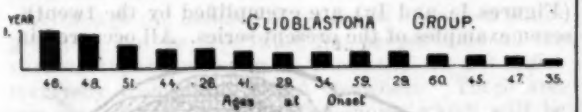

FIGURE II.
Showing the ages of onset and approximate clinical durations of fourteen glioblastomata.

The histological diagnosis depends on the following features. The tumour on section is seen to be highly cellular, while many of the cells show mitotic figures; variety in the size and the shape of the individual cells is common; some of them may be multinucleated and attain astonishing size. Great variation may also be noticed in the forms assumed by the cells; thus one single section may show rounded, pear-shaped, polar or even asteroid forms. Russell has pointed out[11] that "inclusion bodies" may be seen in the nuclei of the larger cells which are not unlike similar bodies observed in the cells of the nervous system in virus infections. It is probable that the mitotic index is a better indication of the malignancy of a tumour than the resemblance of the cells to those of embryonic tissue.

The vascular system shows very characteristic changes. Not only are there many new vessels, but the endothelium of the vascular tree may proliferate to an extraordinary extent, producing large glomerulus-like structures, the presence of which always strongly suggests the diagnosis of *glioblastoma multiforme*. A marked fibroblastic reaction is also frequently observed about the vessel walls. Partly as a result of these changes, hæmorrhages and thromboses are common, and may be responsible for a dramatic clinical onset, or for a sudden exacerbation of symptoms. Degenerative changes are usually prominent, and may result in a sponge-like centre, which suggests that we are dealing with an encapsuled tumour. Unfortunately, the so-called capsule may be a margin of exceedingly active tumour substance, of which the rate of growth is rather enhanced by operation.

The great majority of these tumours rapidly recur after removal. The removal of an entire lobe of brain has occasionally resulted in greater success, but even with this, or the more drastic procedure of removal of a cerebral hemisphere down to the basal ganglia, recurrence seems almost inevitable.

The presence of areas of more differentiated tissue has often been observed in glioblastomata. The interpretation originally given of this by Bailey and Cushing was that it represented differentiation of the embryonal tumour cells into a tissue of a higher order. However, it is freely acknowledged that the cerebral astrocytoma may become transformed into the glioblastoma,[12][13] and it seems logical to regard the glioblastoma as an anaplastic tumour. It may therefore be considered as resulting from anaplastic changes occurring in the cells of some adult tissue, or supervening in a tumour composed of differentiated cells. At the same time some degree of redifferentiation undoubtedly occurs, as in tumours of a non-glial nature.

In this particular series, areas of glioblastoma were found in association with areas of astrocytoma, of ependymoma, of polar spongioblastoma, of astroblastoma and in a tumour originating in the pineal gland. The interpretation adopted was that a differentiated tumour had undergone anaplastic transformation.

At times it may be difficult to distinguish the glioblastoma from areas of markedly anaplastic carcinoma, although the ordinary carcinomatous metastasis is of characteristic structure. Where a gross degree of anaplasia has occurred, it may require the full range of the silver and gold methods of impregnation to make this distinction. Although certain of the glioblastomata do not differentially stain, astrocytes derived from the invaded tissue are usually present, near the growing edge, and in the vicinity of the vascular channels; these are not observed within the carcinomata, where any astrocyte which is enclosed is speedily destroyed.

This difficulty does not usually arise at autopsy where a full and careful examination has been made, but may present a real problem when portion of a tumour has been removed at operation, or when the brain alone has been examined.

The *glioblastoma multiforme* must always be suspected in an adult when the cerebral hemispheres are the seat of a rapidly progressive lesion. It is unusual for it to occur within the brain stem or

within the cerebellum; in these situations tumours of a more favourable type are more frequent. The positions and approximate sizes of the glioblastomata encountered in this series will be seen from Figures IA and IB.

Although life was occasionally prolonged for a few months by the operation of simple decompression, no example was satisfactorily removed, nor did the subsequent autopsy support the belief that such a procedure could have been seriously contemplated. Most of these tumours were too widely infiltrating, illustrating the well-known dictum that a cerebral tumour is usually much more extensive than the clinical signs and symptoms suggest.

The value of deep X ray therapy has yet to be proven. It, with radium, seems to offer the only possibility of controlling an activity of growth, which may be accentuated by attempts at removal, or even by simple decompression.

Highly Cellular Gliomata.

All examples of highly cellular tumours of the cerebral hemispheres or elsewhere in the central nervous system cannot be included with the glioblastomata if we accept a strict classification. Cushing's remarks upon the protoplasmic astrocytomata of the cerebrum have been quoted. I have examined examples of highly cellular tumours which cannot be placed within any accepted class, although they seem to be glial tumours. They do not differentially stain by either the gold sublimate or the silver carbonate methods, although occasionally small polar or asteroid cells may stain differentially with gold or silver; neither do they always show the abundance of mitotic figures that is such an obvious feature of the glioblastomata. They are usually highly vascular tumours, but the endothelium of the vessels is relatively inactive as compared with that of the glioblastoma. It seems probable that the cells are anaplastic cells, of which the rate of subdivision is usually, but not always, somewhat slower than that of the cells of the glioblastoma. Possibly when these have been better analysed, several groups of rather malignant tumours will be found to have been included in this one group.

One type is exemplified by the following.

A small cortical tumour 20 millimetres in diameter was found in a youth, who died for no apparent reason two weeks after a head injury. It was situated in the cortex of the upper portion of the right parietal lobe, and was of the infiltrative type, although apparently well defined. Many small thin-walled blood vessels were present, the spaces between being packed with numerous columnar and cuboidal cells, many of them lining the vascular channels. These cells did not stain selectively, although here and there they resembled very small immature astrocytes.

Other examples might have been described as "near astrocytomata". Many astrocytes were present, but there was a well marked groundwork of undifferentiated cells, and mitotic figures were numerous.

Other histological types will be referred to when the medulloblastomata and oligodendrogliomata are being dealt with.

In all probability there is a gradual transition between any of the differentiated tumours about to be described and the more active types already described.

The Astrocytoma.

Twenty astrocytomata occurred in this series. As its name astrocytoma indicates, it is composed of cells which are brain astrocytes. At times the typical picture of the fibrillary astrocyte is retained, such tumours being firmer than brain tissue, often well defined and eminently removable. The astrocyte may, however, become swollen and show numerous protoplasmic processes; it is then described as a protoplasmic astrocyte. The analogy with the protoplasmic astrocyte of the cortex need not be carried too far, for, as Penfield has pointed out, degenerative changes will produce the same alteration in the form of the astrocyte. Generally speaking, the protoplasmic astrocytoma of the cerebral hemispheres tends to be of a more malignant nature than the fibrillary type. This distinction in malignant disease does not usually exist in the case of the cerebellar tumours, nor yet in the intramural tumours associated with cysts.

Tumours of this latter type are the dream of the neuro-surgeon. Here nature, by the formation of a non-neoplastic cyst outside the wall of the tumour, has partly completed its isolation. The cyst may merely isolate one aspect, but frequently it is of such a size as to dwarf the tumour, which is left as a small nodule within its wall. If the cyst be opened and the nodule completely removed, the tumour does not recur; if the surgeon is content with opening the cyst and does not or cannot remove the tumour, the cyst refills; moreover, at some future date he may find the cyst replaced by solid growth.

Five of the astrocytomata that I have examined were associated with single large cysts of this type. Three of them occurred in the cerebellum, one in a frontal lobe, and one near the region of a Sylvian fissure. It is to be regretted that three were not diagnosed. One cerebellar tumour was discovered in a woman of fifty, who died subsequent to a gastro-enterostomy for a duodenal ulcer; a second, occurring in a similar position, was found in a man of thirty-eight, who had been treated for many years for shell shock; a third was discovered in the frontal lobe of a man of forty-nine, who was found unconscious in bed. The fourth was correctly diagnosed in a boy of fourteen, but was not able to be removed. The fifth was satisfactorily removed by Dr. H. C. Trumble from the region of the left Sylvian fissure.

Similar cysts may be found in association with the other slowly growing tumour types, or even in association with inflammatory masses. The cysts contained within the tumour substances may be of this exudative type, or may be the result of degenerative changes.

Unfortunately, all astrocytomata are not in the form of removable nodules; some are so diffuse as to render their removal an impossible task. In this type, above all others, the clinical signs may give no idea of the extent of the tumour, as many unaltered axones may persist within the tumour substance.

A man of forty-four was found with the signs of internal hydrocephalus. These drew attention to an intracranial condition, of which the only localizing signs were tremor of the left arm, with some defect in the position sense. Death followed a decompression operation which was undertaken six months after the onset of symptoms. At autopsy an enormous tumour mass was found extending from the left frontal lobe to the vertex, and of such poor definition that tumour tissue could with difficulty be distinguished from the white matter of the brain. The pyridine silver stain showed the tumour cells to be intermingled with a dense network of apparently unaltered neurones.

The transformation of the protoplasmic astrocytoma of the cerebrum has been commented upon.[5][12][13] This occurred in one example in this series following a decompression operation. At death some time later, the area beneath the decompression opening presented the appearance of the glioblastoma, while the edge away from this area was astrocytoma.

Many other types of astrocytoma have been named, and it is essential for the neuro-pathologist to appreciate the various modifications of form assumed by the tumour astrocyte. A description of these would be out of place here; they may be studied in the excellent atlas published by Roussy and Oberling.[15]

The cerebellum of the young is a favourite site for the astrocytoma, although occurring in this position at any age. The cerebral type is more common in adults and much less favourable than the former. The majority of the astrocytomata that I have examined occurred in adults; eight were found in the cerebellum, six in the cerebral hemispheres and six in the brain stem.

The slow evolution of the cerebellar examples studied in this series will be observed by reference to Figure III. The cerebral astrocytomata by no means followed such a slow and prolonged clinical course; their onset was at times startling in its suddenness, and their course as brief as that of a glioblastoma. The cerebral hemispheres may be occupied by a tumour which produces little to indicate its presence, whereas one of similar size in the posterior fossa would have long since declared its position.

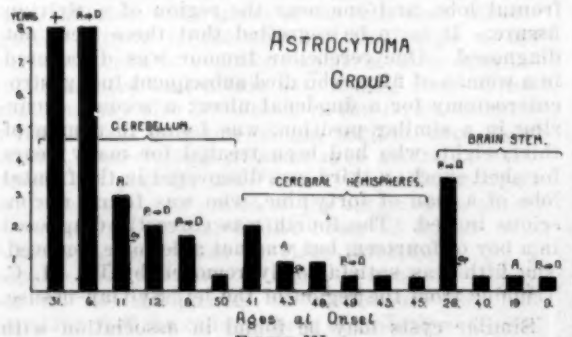

FIGURE III.

Showing the ages of onset and approximate clinical durations of sixteen astrocytomata of the brain. The vertical line indicates the duration in years. A indicates that the patient is still alive. P-op.D. indicates that the patient died a short time subsequent to operation. Op. indicates the period at which an operation was performed. + indicates that the period of clinical duration was probably greater.

The Ependymoma.

Tumours derived from ependyma are among the less common intracranial growths. Seven such tumours derived from six patients occurred in this series. Ependymomata usually arise from the lining of the ventricles, or from some adjacent part, with a predilection for the roof of the fourth ventricle; hence the majority of examples are found in the cerebellum. They may also arise from ependymal remnants which have become separated from the ventricular system, such "rests" having been noted about the floor of the fourth ventricle and elsewhere. Although among the less common tumours of the brain, they are easily the most common intramedullary tumours of the spinal cord, forming no less than 40% of Kernohan, Woltman and Adson's cases.[16] The opportunity for the survival of small areas of ependyma is apparent in this region in which so much of the original medullary canal has undergone obliteration.

Ependymomata are usually well defined and firmer than brain tissue. They offer excellent opportunities of removal if situated in the mid-cerebellar region, although recurrence is usual. Unfortunately, the prospects are not so favourable in the cerebral type, where the site may be very difficult of approach.

They may show calcification and be visible in the skiagram. Fincher and Coon[17] write that they form the most frequently calcified tumours of the cerebral hemispheres in children.

The ependymomata present at least three distinct histological pictures. In one, cuboidal cells derivatives of ependyma are prominent. One may have to resort to special stains for the blepharoplasts within their cytoplasm to prove their ependymal nature, unless clefts lined by ependyma occur, or unless some more characteristic picture is present in the same tumour.

Bailey and Cushing describe a second type as ependymoblastoma. In this are found polar forms with long narrow processes, radiating from thin-walled vascular channels. This distinction in type may be abandoned for practical purposes; Woltman and Adson have clearly shown that these two formations, together with one to be described, may all be present in the same tumour.

In this series a large tumour was found in a man of sixty, completely filling one lateral ventricle, and showing in the main the picture of cuboidal and columnar ependymal cells. A separate tumour, the size of a small cherry, was present in the mid-line of the cerebellum. In this two distinct macroscopic appearances could be observed, the one fleshy, showing the typical picture of the ependymoma, the other with many parallel vascular channels, showing the typical appearance of the ependymoblastoma.

Another tumour of this second type, occurring in a woman of twenty, was found to be occupying the anterior horn of the right lateral ventricle, and to have approached the surface of the brain. Like the previous example, it was of large size.

I would have regarded each of these tumours as being inoperable. However, when one considers the enormous tumours which have been reported as being removed, it is necessary to modify this opinion somewhat.

The period of growth of these two neoplasms was much more prolonged than that of the glioblastomata; the first had a survival period of two years, death resulting from a cerebral hæmorrhage quite independent of the growth; the second a survival period of four years and two months, death following an attempt at removal.

Of the five cerebellar tumours, four presented the appearance of the ependymoblastoma. I am indebted to Mr. Leonard Lindon, of Adelaide, for one of these, which he had successfully removed.[18]

The third and least common type was represented by an apparently innocent cyst occurring in the mid-cerebellar region. A microscopical section of the wall showed an appearance not unlike that of thyreoid acini. Many tumours of this type have been described as "neuro-epithelioma". This appearance is, however, uncommon, except in the ependymomata of the spinal cord.

The survival period of the cerebellar ependymomata has been less than that of the cerebral examples in this series (Figure IV). Of the three

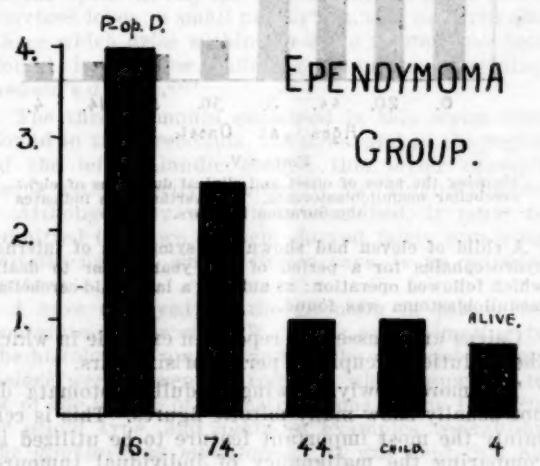

FIGURE IV.

Showing the ages of onset and clinical durations of five ependymomata. The vertical line indicates the duration in years. P.-op.D. indicates that the patient died soon after operation.

in which it was accurately determined, it was ten months and eight months respectively in two of them, while one still survives after removal. Although they are frequently encountered in children, two of my ependymomata were found in adults. They are often well defined tumours, with a fairly long period of regrowth. Every attempt should therefore be made to remove as much of them as is possible. This removal can rarely be complete, particularly in the cerebellar type, where the proximity of the vital centres in the floor of the fourth ventricle makes such an attempt extremely hazardous.

The Oligodendroglioma.

If the neurones be excepted, oligodendroglial cells are the most numerous elements encountered in the brain, classical astrocytes being much less numerous. It may therefore cause us some surprise to find that tumours derived from oligodendroglia are much less numerous than those derived from astroglia. The oligodendrocyte, although morphologically and histogenetically closely related to the astrocyte, is a more highly specialized cell, and possesses its own peculiar staining properties; moreover, it is exceedingly fragile and difficult to demonstrate satisfactorily, unless the tissue be fixed immediately after death.

Tumours composed of cells of the oligodendroglial series were first identified by Bailey, although the literature contained references to tumours which may have been identical, described under a variety of names.

The oligodendrogliomata form 3·5% of the Bailey-Cushing series. Only two examples occurred in this series, or 2·4% of the gliomata. They are usually well defined, slowly growing tumours with a marked tendency to calcify; they are accordingly frequently visible in the radiogram. As no oligodendroglioma has yet been identified beneath the tentorium, we need not consider this diagnosis when calcification is visible in this position. On the other hand, the appearance of a calcified tumour in the radiogram of the cerebral hemisphere of an adult should always bring to our mind the possibility of an oligodendroglioma being present.

Each of the tumours that I have examined was related to the ventricular system, but neither showed calcification. One was growing from the *corpus callosum* into the anterior horn of the left lateral ventricle; the other from the left frontal lobe into the region of the foramen of Monro. Each was well defined; the second would have been eminently removable had the encephalogram demonstrated its position. The ventricular system showed marked general dilatation, but no filling defect was observed in the region of the growth.

Cushing has lately drawn attention to the fact that these tumours may not be as innocent as first appeared: many of them have shown mitotic figures, and have recurred fairly soon after removal. This unexpected evidence of malignancy is present despite the tendency to calcify. The boundary between these more active examples and the so-called cerebral medulloblastoma is not well defined. The latter is less active than its cerebellar type, and shows, unlike it, a tendency to calcify.

The histological appearances are fairly characteristic, even in the ordinary paraffin sections. The tumour cells are small, often showing a clear zone between the nucleus and the cell margin. The

Hortega silver carbonate stain, or one of its modifications, usually shows oligodendrocytes, although the majority of the cells have not, as a rule, attained this degree of differentiation. The excellent papers of Bailey, and Bucy,[19] or Kwan and Alpers,[20] may be consulted for more exact details of their histology.

The Medulloblastoma.

The medulloblastomata form an exceedingly important group of cerebral tumours. They have often been classified in the past as small celled sarcomata. Bailey substituted the name medulloblastoma for certain reasons. Schaper had postulated a cell within the nervous system which possessed a dual potentiality; it might differentiate either along the line of the nerve cell or of neuroglia. When Bailey examined these tumours by special methods, he found cells, some of which appeared to be spongioblasts, while others appeared to be neuroblasts. These represent both lines of differentiation, and therefore it seemed to him that the mother cell of the tumour should be considered as the hypothetical medulloblast. However, such able neuro-histologists as Penfield[14] have been unable to identify neuroblasts in these tumours. In the examples that I have examined, no neuroblasts were found, nor could the polar forms, which not infrequently occur, be identified with any certainty as spongioblasts. It must be confessed that a slide of the small celled embryonal sarcoma of kidney could easily be transposed without detection. Medulloblastomata usually occur early in life, and have been noted in twins.[21] There is, therefore, a certain amount of evidence that they may be embryonal tumours analogous to those found within the kidney.

The cerebellar type is characteristic and important. The patient, usually a young child, develops the signs of an internal hydrocephalus, together with clinical features which suggest that the cerebellum is involved. A tumour is found in the midline of the cerebellum, growing from the region of the roof plate of the fourth ventricle. It is not particularly vascular, but is so soft that it may be partially removed by suction. Unfortunately, it rapidly recurs, and moreover signs may develop which suggest that it may be implanted in other areas such as the spinal subarachnoid space.

Like many other small round celled tumours, it is extremely radio-sensitive, and radiotherapy may for a short time keep it in check. In this sensitivity it differs markedly from the other glial tumours. Its capacity to sow itself in the subarachnoid spaces of the cerebro-spinal axis is great: at times the extent of this sowing merits the name "diffuse sarcomatosis of the meninges", which, although resulting from metastases from other tumours, glial and otherwise, is usually the result of the sowing of a medulloblastoma, in which a small primary tumour has escaped detection.

In this series, in a woman of thirty-five, multiple tumours of this type were discovered in the subarachnoid spaces of the vertex, of the cerebellum, of the spinal cord, and of the *conus medullaris*. There was certainly no tumour within the fourth ventricle, and no decision could be reached as to which of the other tumours represented the primary growth.

The microscopic appearance is monotonous, presenting a dense mass of small round cells. In some examples the cells are larger; in others spindle-shaped forms are common and occasionally extremely numerous. Mitotic figures are frequent in the more active tumours.

The study of the nine medulloblastomata encountered in this series has shown two dissimilarities to those studied by Bailey and Cushing. Four out of the eight cerebellar tumours were found in adults. Moreover, the history of the evolution of many of them was prolonged, and by no means indicated that they should be placed above the *glioblastoma multiforme* in the scale of malignancy.

A glance at Figures I and V will show the great disparity between the periods of evolution of these two types.

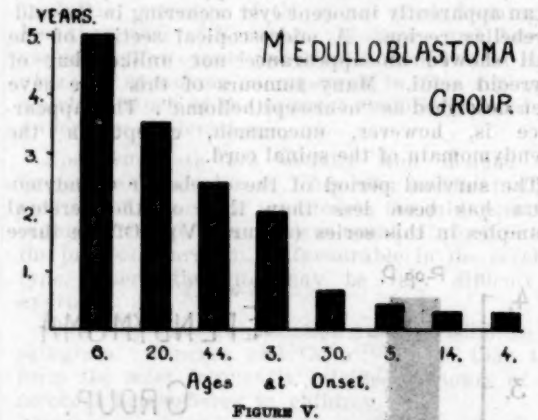

FIGURE V.

Showing the ages of onset and clinical durations of eight cerebellar medulloblastomata. The vertical line indicates the duration in years.

A child of eleven had shown the symptoms of internal hydrocephalus for a period of five years prior to death which followed operation: at autopsy a large mid-cerebellar medulloblastoma was found.

Cairns and Russell[22] report an example in which the evolution occupied a period of six years.

The more slowly growing medulloblastomata do not usually show many mitotic figures. This is certainly the most important feature to be utilized in comparing the malignancy of individual tumours.

From the study of the eight cerebellar cases, it is apparent that there is a form of medulloblastoma of much slower evolution than is usually recognized; the possibility of its occurrence must be considered in the cerebellar tumours of adults, and in those tumours where multiple metastases occur. In other glioma types, metastases do not usually produce clinical signs,[22][23] the medulloblastoma easily occupying pride of place as the cause of metastatic deposits within the subarachnoid spaces of the spinal cord and the basal cisterns. This feature must be considered in their surgical treatment:

where the primary growth has been disturbed, it is probably wise to irradiate the cerebro-spinal axis as a prophylactic measure against implantation.

The cerebral medulloblastomata do not form a very distinct group: it is possible that several varieties of tumour may have been included under this designation. Three tumours occurred in this series which might have been so described, although only one was definitely accepted as an example. I have preferred to place the other two with the highly cellular gliomata of indefinite appearance.

The example described as a medulloblastoma was a huge fungating tumour occurring in the lateral ventricle of a child. It showed appearances indistinguishable from the cerebellar medulloblastomata, but with areas of spindle cell formation. Mitotic figures were numerous.

No medulloblastoma in this series was successfully removed at operation.

The Polar Spongioblastoma.

In polar spongioblastomata strains of interlacing fibres are found, the processes of numerous unipolar and bipolar cells. These processes stain diffusely with the neurological stains, but do not show fibrillæ. The tumour type very closely resembles the astrocytoma in its general appearance and behaviour. They are uncommon, forming 2·8% of the Cushing gliomata, and 3·5% of the gliomata analysed in this paper. Their position is inconstant; they are most commonly found in relation to the optic nerves, the cerebellum, the pons, or the cerebral lobes; a small proportion, and in particular those which arise within the optic tracts, have been found in persons suffering from von Recklinghausen's disease.[24]

The three tumours examined in this series were found in the cerebellum, the pons, and in the region of the left Rolandic fissure, this latter example being satisfactorily removed by Mr. Hugh Trumble.

Although they were thus classified, it must be admitted that two of them showed fairly numerous mitotic figures, which, Bailey says, is an unusual feature.

I have surveyed all the gliomata in this series containing polar cells.[10] Areas approximating to the histological appearances of the *spongioblastoma polare* were present in tumours which appeared to be of the nature of the astrocytoma of the fusiform or piloid type, and again in examples resembling the *glioblastoma multiforme*. It was held that all grades of transition might occur between the "piloid" astrocytoma and the glioblastoma, the pure type of the *spongioblastoma polare* being intermediate. The question was raised as to whether the spongioblastomata could not be included as a subtype of the astrocytoma. For a full description of these tumours, the reader is referred to the recent paper of Bailey and Eisenhardt.[25]

The Astroblastoma.

The appearance of the astroblast of histogenesis is that of a cell with one main sturdy process, by which it is attached to a blood vessel or to a connective tissue septum. Tumours containing cells which in the main present this appearance, have been described as astroblastomata.

This appearance may, however, be assumed by astrocytes, in which the subsidiary processes have undergone degeneration; and Roussy and Oberling see in the astroblastoma a degenerating astrocytoma.[15]

Numerous "astroblasts" were observed in six tumours encountered in this series; four of these were, however, more of the nature of the glioblastoma. The astroblastomata are unsatisfactory from the operative standpoint, as may be seen from the results cited by Bailey and Bucy.[26] The majority are found in the cerebral hemispheres of adults, and are apt to recur rapidly after removal.

They appear to be intermediate in type between the protoplasmic astrocytoma of the cerebrum and the *glioblastoma multiforme*. As has been noted, degeneration between vascular channels lined by astrocytes may modify their appearance so that they resemble astroblasts.

The majority of the tumours which correspond to the Bailey-Cushing description might be gathered into the group of the cerebral protoplasmic astrocytoma.

One tumour in this series, which was classified as astroblastoma, occurred in a woman of forty-seven. The entire history to death, which followed the usual manifestations of internal hydrocephalus, was five weeks. A small, fairly well defined and relatively avascular tumour was found at the junction of the right occipital and parietal lobes. In section, many "astroblasts" could be observed with thick processes set upon vascular channels and connective tissue septa. The degeneration, so common between the vascular channels of these tumours, was marked; the appearance could easily be interpreted as the result of degeneration occurring between areas of swollen protoplasmic astrocytes, and did not suggest the subdivision of cells arrested at the stage of the astroblast of histogenesis.

The average duration of life in the original 13 cases analysed by Bailey and Cushing was twenty-eight months.[8]

We have here apparently an inconstant tumour type, certain examples of which incline to the *glioblastoma multiforme*, while others are allied to the protoplasmic astrocytomata of the cerebrum.

The Pinealoma.

Pinealomata, though relatively uncommon, are of considerable clinical importance. The variations in their histology have been well described by Globus and Silbert[27] and others. Their origin is from the pineal body, or from its neighbourhood, from whence they may grow forwards into the posterior part of the third ventricle, into the quadrigeminal plate, or downwards into the cerebellum. The histological appearance is variable. The large cell of the pineal parenchyma is found associated with a small round cell, which is presumably of mesoblastic origin, as it appears to give rise to fibrous tissue.

Three pinealomata occurred in this series. In one degeneration was extreme, and no definite histological appearance could be observed. In the second, occurring in a child, the tumour was highly malig-

nant, and actively growing in the subarachnoid space, between the folia of the cerebellum. The cells were of the large type, many being of giant size, while mitotic figures were numerous. The third tumour occurred in a woman of thirty-eight, and conformed more to the usual type. It was well defined, calcified and fibrotic, with few mitotic figures.

It appears, then, that varying grades of malignancy may be encountered in pinealomata.

Bailey is very certain that the pineal cell may differentiate along the line of the neuroblast, or of the astrocyte; tumours composed of or containing these elements may therefore be expected in this region. Globus and Silbert have not found, however, such cells in these tumours, and regard them when present as being inclusion forms.

In the two pinealomata that I have studied by the special methods, no such elements were observed except in that region where the quadrigeminal plate had undergone penetration; they were regarded therefore as inclusion elements.

The rarer varieties of glioma will not be considered here. Their clinical importance is small, and their histological features are by no means settled. For information the reader is referred to the various publications of Bailey and Cushing.[1][8][9] I have referred to them also in another publication.[10]

In analysing the Bailey-Cushing classification of 1926, or its recent modifications, it appears that a classification based on the similarity of the neoplastic cells to those observed in histogenesis does not present an exact picture of these tumours; nor is it entirely in accordance with the expected rate of their evolution. This type of classification has never been entirely satisfactory for any tumour group. The phenomena of anaplasia and metaplasia produce too many modifications in the appearance of individual cells to permit of names based on normal histogenesis being accurately applied to them. Alterations in the blood supply of a tumour, physical factors, as the relation of the cell to the position in which it grows, the chemical action of degeneration products, all produce modifications of the tumour cell which may mislead him who observes them with the eye of the embryologist.

The views of the French school form an excellent corrective to this earlier classification based on embryogenesis: the pathologist will find very few pictures upon which light may not be thrown by the excellent atlas of Roussy and Oberling.[15]

At the same time, the value of the subdivision of the gliomata into definite groups of a fairly definite clinical and histological picture is inestimable. Although many of the names used are likely to undergo modification, the classification of Bailey and Cushing must remain as an important landmark in the study of these tumours.

I have temporarily adopted the following classification, retaining the names used by Bailey and Cushing, as they form at present the common language of the English-speaking world.

A. Tumours composed of mature cells.
   1. Astrocytoma and its modifications.
   2. Oligodendroglioma.
   3. Ependymoma.
   4. Pinealoma.
   5. Ganglioneuroma (rare).
B. Anaplastic tumours.
   1. *Glioblastoma multiforme.*
   2. Various highly cellular undifferentiated gliomata.
C. Transitional types.
   1. Polar spongioblastoma.
   2. Astroblastoma.
   3. Various highly cellular partially differentiated gliomata.
D. Embryonal tumours.
   Medulloblastoma.
E. Rare tumours which require further study.
   1. Medullo-epithelioma.
   2. Neuro-epithelioma.

The Fibroblastoma Group.

Tumours derived from mesoblastic structures, as the meninges, the cells of the arachnoidal villi, and the sheaths of the cranial nerves are now considered to be, have been gathered under the name fibroblastoma. This name includes two extremely important groups, the meningeal fibroblastomata and the perineural fibroblastomata.[30] For the first type Cushing still retains the convenient term "meningioma", which he chose in preference to the older and incorrect name of "dural endothelioma".

Each of these tumour types merits separate description. They are common, and must be clearly distinguished from the gliomata, not only in that they are not of epiblastic origin, but also from a practical standpoint; they compress, but do not invade, the brain. Should they do so, the term sarcoma would be applicable.

The Meningeal Fibroblastoma or Meningioma.

The recent percentage for meningeal fibroblastomata or meningiomata in the Cushing Clinic is 13·4.[1] Tooth also found a percentage of 13·4.[12] Fifteen meningiomata occurred in this series, a percentage of 11·1

The favourite site of the meningioma is towards the anterior two-thirds of the cerebral hemispheres, but they also occur in the region of the occipital lobes, and in the cerebello-pontine angle.

Figures VIA and VIB show the approximate sizes and positions of the tumours encountered in this series. Their origin is thought to be from clumps of arachnoidal cells; these are not only found in the arachnoidal villi along the venous sinuses, but also at the foramina of exit of the various cranial nerves. This origin from the arachnoid is not always clear; an occasional extradural tumour has been reported, where no attachment to the arachnoid could be demonstrated. Moreover, a small but well recognized group may be found entirely buried within the brain substance; while rarely a tumour is found growing within the ventricular system. It is necessary to postulate for these less common sites the presence of aberrant arachnoidal cells.

The meningeal fibroblastomata usually become adherent to dura, and show an area of attachment to the region of one of the intracranial sinuses. They are well defined tumours, not invading brain, but at times growing into the cranial bones, by way

of the Haversian canals. A considerable amount of new bone may thus be laid down, resulting in exostoses and thickenings of the cranial vault, while less commonly the tumour may grow through the skull and produce a large external mass.

This invasion of bone was uncommon in this series, only occurring with one tumour, stalactite

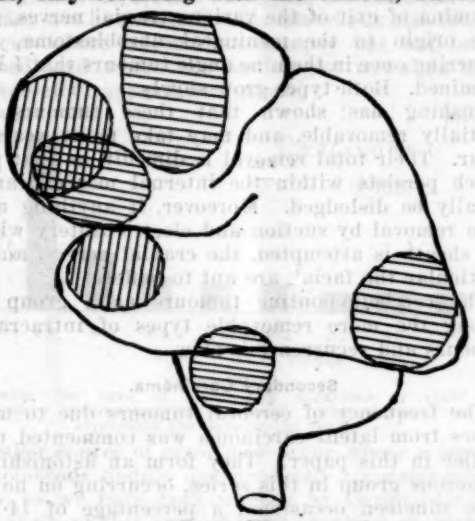

FIGURE VIA.
Showing the approximate locations and sizes of certain of the meningeal fibroblastomata (meningiomata.)

formations from the skull being marked. Exostoses were also observed in another in the region of an orbital plate. More commonly a general thinning of the cranium, due to pressure absorption of bone, was found in the region of the growth.

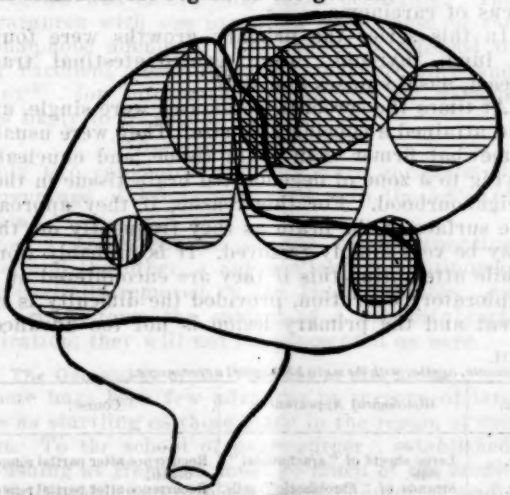

FIGURE VIB.
Showing the approximate locations and sizes of certain of the meningeal fibroblastomata (meningiomata.)

Owing to the extraordinary vascularity which may occur in neighbouring structures, hæmorrhage is a serious problem during their removal. Cushing has written that they are the only type of intracranial tumour for which he finds it necessary regularly to prepare prior to operation for blood transfusion.

Even so, the meningiomata form one of the most favourable operative types, owing to their superficial position and their non-invasive nature. Their rate of growth is variable, but is usually slow. Figure VII shows the period of evolution of certain of the tumours which I have examined, together with the age at the onset of the first ascertainable sign or symptom. It illustrates the point that they are by no means confined to adult life as is often stated.

Their histology is variable. The type cell is now usually accepted as a fibroblast, although Bailey and Bucy are in opposition to this view.[28] Large "arachnoidal" cells may be found arranged in sheets or in well marked whorls, closely resembling the arachnoidal villi in appearance. If these whorls are calcified, they are known as psammoma bodies and the tumours as psammomata.

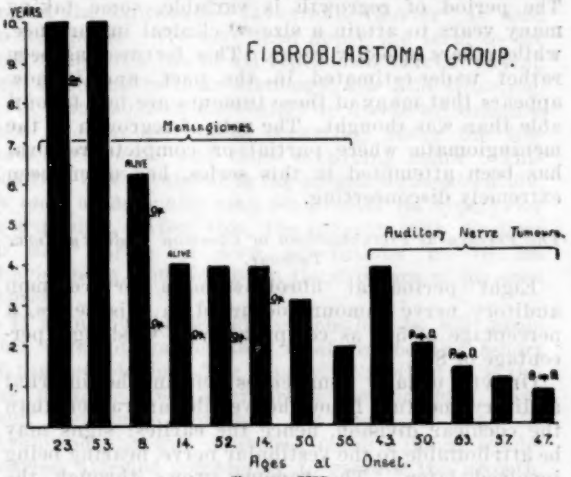

FIGURE VII.
Showing the ages of onset and clinical durations of thirteen meningeal fibroblastomata (meningiomata). The vertical line indicates the duration in years. P.-op.D. indicates that the patient died a short time after operation. Op. indicates the period at which an operation was performed.

Other examples approximate more in appearance to the common fibroma, with strands of fibroblast-like cells. If there is much fluid accumulated between the individual cells, the tumour may resemble a myxofibroma. Palisading of nuclei is uncommon in the meningeal type, although frequently to be noted in the perineural form. It was observed, however, in an example removed by Mr. H. C. Colville in 1930 from the left fronto-parietal region of a girl of sixteen. This tumour recurred, and was again removed, apparently in its entirety at the end of 1932. The histological appearances were identical on each occasion.

Bailey and Bucy[28] have analysed the histological appearances of this group. They have constructed a classification based on the resemblance of the cells to adult and embryonic forms, and describe nine types: (*a*) a mesenchymal type; (*b*) an angioblastic type; (*c*) a meningo-theliomatous type, composed of sheets of arachnoidal cells; (*d*) a psammomatous type; (*e*) an osteogenic type; (*f*) a fibroblastic type; (*g*) a rare melanotic type; (*h*) a type resembling a diffuse sarcoma; (*i*) a very rare lipomatous tumour.

Table III shows an attempt to associate the histological appearances of meningiomata with their rate of growth. It will be seen that there is no definite correspondence.

In conclusion, attention should be drawn to the occurrence of meningiomata in the more anterior parts of the brain, where they may result in psychoses of various types.

Cerebral tumours are not common in autopsies on asylum patients, but Davidoff[29] has pointed out that 30% of the cases in his series were of this nature. In this series, one out of three examples obtained from asylums was a meningioma, the other two being secondary carcinomata.

It is not always possible to remove totally the meningeal fibroblastomata. Even when removal seems to have been complete, recurrence is frequent. The period of regrowth is variable, some taking many years to attain a size of clinical importance, while others speedily recur. This feature has been rather under-estimated in the past, and it now appears that many of these tumours are less favourable than was thought. The rate of regrowth in the meningiomata where partial or complete removal has been attempted in this series, has often been extremely disconcerting.

The Perineural Fibroblastoma or Common Auditory Nerve Tumour.

Eight perineural fibroblastomata or common auditory nerve tumours occurred in this series, a percentage of 5·9, as compared with Cushing's percentage of 8·7.

Growth usually commences within the internal auditory meatus, from the vestibular rather than the cochlear division, hence the earliest signs may be attributable to the vestibular nerve, hearing being involved later. The tumour grows through the meatus into the cerebello-pontine angle, where it may produce a formidable mass, compressing the cerebellum, dislocating the brain stem, and sooner or later resulting in an internal hydrocephalus.

The perineural fibroblastomata are well defined tumours, and do not invade the brain substance. In section they show strands of fibroblast-like cells, the elongated nuclei of which are often arranged in palisade formation, while other areas may present a myxomatous appearance. The nerve fibres do not usually penetrate the tumours, but are stretched and fanned out within their sheaths. This is in contrast to the type associated with von Recklinghausen's disease, where the fibres may traverse the tumour substance. They may be bilateral, as occurred in one of my specimens.

It must not be thought that all fibroblastic tumours of the cerebello-pontine angle are of this type; groups of arachnoidal cells, related to the foramina of exit of the various cranial nerves, may give origin to the meningeal fibroblastoma, this occurring once in the nine angle tumours that I have examined. Both types grow slowly.

Cushing has shown that these tumours are partially removable, and may take many years to recur. Their total removal is difficult, as that part which persists within the internal meatus cannot usually be dislodged. Moreover, if anything more than removal by suction and electro-cautery within the sheath is attempted, the cranial nerves, and in particular the facial, are apt to suffer.

The cerebello-pontine tumours as a group are among the more removable types of intracranial tumours and recurrence is slow.

Secondary Carcinoma.

The frequency of cerebral tumours due to metastases from latent carcinoma was commented upon earlier in this paper. They form an astonishingly numerous group in this series, occurring on no less than nineteen occasions; a percentage of 14·1 of so-called "primary brain tumours". As secondary carcinoma is a rarity in childhood, we observe the great frequency of these tumours among adults who have reached the carcinoma age. It seems hardly necessary to add that in every adult of this age who presents the clinical features of brain tumour, a thorough search should be made for a primary focus of carcinoma.

In this series the primary growths were found in lung, thyreoid, ovary, gastro-intestinal tract, breast, nasal sinuses and skin.

At times the cerebral metastases were single, and had attained a considerable size. They were usually somewhat firmer than brain tissue, and enucleable owing to a zone of degenerated brain tissue in their neighbourhood. For this reason, if they approach the surface of the brain as they frequently do, they may be very simply removed. It is probably worth while attempting this if they are encountered at an exploratory operation, provided the difficulty is not great and the primary lesion is not too advanced.

TABLE III.

Showing the ages of onset and the clinical durations of ten meningiomata, together with the main histological appearances.

Number.	Initial.	Sex.	Age.	Situation.	Duration.	Histological Appearances.	Course.
1	J.	F.	52	Right frontal lobe.	4 years.	Large sheets of "arachnoidal" cells.	Recurrence after partial removal, death.
2	B.	M.	14	Right parieto-occipital.	2 years.	Strands of "fibroblastic" cells.	Recurrence after partial removal, death.
3	I.	M.	23 (or less)	Right and left occipital.	10 to 15 years.	Small whorls.	Recurrence after partial removal, death.
4	C.	M.	56	Right frontal.	2 years.	Whorls.	Incorrectly placed operation, death.
5	K.	M.	58	Left cerebello-pontine.	A few months.	Well-defined large whorls.	Death following encephalography.
6	D.	M.	61	Right parietal lobe.	3 years.	Whorls.	Asylum death.
7	S.	F.	14	Suprasellar.	4 years+.	Whorls with calcification.	Partial removal, surviving.
8	L.	M.	60	Right occipital.	Symptomless.	Strands of "fibroblastic" cells.	Death from uræmia.
9	R.	F.	10	Right parietal.	5 years+.	Strands of spindle cells with "palisading" of the nuclei.	Almost total removal on two occasions, surviving.
10	M.	F.	53	Left frontal.	10 years.	Spindle cells.	Asylum death.

No attempt will be made here to describe their varying histological appearances; suffice it to say that the unwary may easily overlook the nature of certain of the unusual varieties. Thus a nodule may be removed, which may in the ordinary paraffin section suggest a gliomatous tumour; if the specific staining methods are not employed, the nature of the cells may not be realized. This mistake is also likely to occur where a complete autopsy has not been obtained, and where the pathologist relies on the morphological appearances alone.

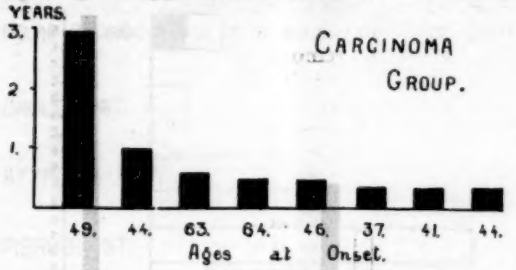

FIGURE VIII.

Showing the ages of onset and durations of eight secondary carcinomata of the brain. The vertical line represents the duration in years.

Another source of error may occur where a small carcinomatous nodule has produced a considerable gliosis, as we have been warned by Carmichael.[7] The margin of this area, if it be obtained at operation, may be examined and pronounced astrocytoma. Figure VII shows the survival period of some of the patients from the onset of symptoms of brain tumour.

Pituitary Tumours.

The number of pituitary tumours encountered in this series was small, only three occurring. The appearances with one exception were those of the chromophobe adenoma. The reader is referred to such excellent descriptions as that of Dott and Bailey[31] for information regarding the various types likely to be encountered.

Congenital Tumours.

Only two congenital tumours were encountered, a percentage of 1·5 as compared with the 5·6% of Cushing.

One, a cholesteatoma of the cerebello-pontine angle, and the other, a suprasellar adamantinoma, were partially removed by Mr. Hugh Trumble. As they are to form the subject of a separate communication, they will not be commented on here.

The Operability of the Tumours of this Series.

There have been few advances in surgery of late years as startling as those made in the region of the brain. To the school of neuro-surgery, established by Cushing at Harvard, must go much of the credit for the illumination of a very dark chapter of medicine, that dealing with the tumours of the brain and its membranes.

There are few cerebral tumours for which an operation of some sort is not expedient. Thus we may produce an evanescent abatement of the clinical course of a malignant and irremovable neoplasm by a suitably placed decompression operation, or under the most favourable circumstances ablate a circumscribed tumour without any risk of its recurrence.

Between these extremes lie many growths for which much may be done to relieve the patient's sufferings, and to extend his life.

The phrase "operable tumour" has not an exact meaning for most of us. Although retaining the word "operability" as covering in general the subject under discussion, I have hesitated to divide the tumours which I have examined into operable and inoperable groups.

I have preferred to describe certain tumours as "favourable" for operation, referred to in this paper as "favourable tumours", while into a second group I have placed those which seem to be less favourable or unfavourable. It is necessary to define with as near an approach to exactitude as possible the meaning of the expression "favourable tumour" as used in this paper. We may then apply the term to the individual tumours of all types encountered, paying due attention to their histology, size and situation.

In doing so, it is convenient to divide all tumours into two groups: those occurring above the *tentorium cerebelli*, and those occurring below. This position of the tumour is the primary consideration, as only occasionally may we predict its type prior to exposure. After this, the surgeon will, needless to say, form his own conclusions as to its enucleability, founded upon the evidence of his own senses.

If a tumour be frankly enucleable, he will probably attempt its removal whatever be the report of the pathologist. The supravital method of staining, or some other appropriate method, may, however, determine for him its type; if this be favourable, he will doubtless make a more wholehearted attempt completely to remove the growth, with the hope that he may add years to the patient's life, rather than the few months which are likely to result from the removal of a malignant type.

In approaching an operation, we must correlate all the clinical knowledge derived from the known behaviour of the various tumour types, to determine as to whether one can predict whether the tumour is likely to be favourable for operation or otherwise.

Our definition of a favourable intracranial tumour must of necessity be modest, for most recur locally. For the purpose of this paper a "favourable tumour" is one which on account of its situation, size and nature may be entirely or partially removed, with substantial relief of symptoms, and without such a degree of physical or mental injury to the patient as to outweigh the advantages derived from the removal of the tumour; moreover, the relief of symptoms from the tumour must last for not less than one year.

An unfavourable or less favourable tumour is one which on account of its situation or size cannot be removed without undue risk or damage to the mental or physical well-being of the patient, or which, owing to the rapidity of its growth, renders any improvement evanescent.

The surgery of the brain has become daring to a degree unknown a few years ago; individual cerebral

lobes have been removed, often with surprisingly little ill effect, and the excision of a cerebral hemisphere down to the basal ganglia has been carried out on more than one occasion. Doubtless, the resultant hemiplegia may not be considered too great a price to pay, provided the personality changes are not great. Due consideration must be given to the predominance of the left hemisphere in the right-handed person, as it would be a calamity to remove such a portion.

In the definition, the period of one year is purely arbitrary. It may be regarded as too short a period to indicate a favourable growth, and it may be pointed out that individual tumours, such as glioblastoma and the medulloblastoma, may be removed with an expectation of recurrence in from six to nine months, with an occasional prolongation beyond the period of one year, and therefore be regarded as favourable for operation.

Because a tumour is regarded as unfavourable, it does not imply that the surgeon, if he finds it easy of access, should not remove as much of it as possible; the few months of added life may be well worth while.

In practice, owing to the hopelessness of the position if nothing is done, operation is usually advised where a tumour is localized and accessible, whatever be the prediction of its nature. If the indications are that it is of the favourable type, it is approached with confidence; if the indications are otherwise, we are occasionally gratified by the discovery of an operable tumour which has presented the features of a rapidly growing and malignant one. A glance at the durations of certain of the favourable types will demonstrate how brief these may be. The occurrence of œdema about a simple cyst or hæmorrhage in a slowly growing tumour may mimic a cerebral lesion as rapid in its progress as a vascular lesion.

It is wise to irradiate the sites of the more malignant tumours after complete or partial removal, as it is probable that this may in some measure retard the rate of subdivision of the tumour cell. There is, however, no very definite information about the effects of radiation upon tumours other than the medulloblastomata, which are definitely radio-sensitive.

Figures IX and X represent the subdivision of these tumours into supratentorial and subtentorial groups. The blackened areas indicate tumours regarded as unfavourable, or less favourable within the meaning of this paper. Thus a tumour may be too diffuse, be situated near some vital centre, or be of such a degree of malignancy that clinical recurrence is likely within twelve months. The unshaded areas correspond to favourable tumours, while those which are hatched represent tumours which, although they were of this type, were so situated as to render the possibility of their removal problematical.

In the supratentorial group one finds first of all 27 glioblastomata, all of which may be regarded as unfavourable; then two astroblastomata, which must be regarded in the same way. The 17 examples of secondary carcinoma would also be included as unfavourable.

Of the unclassified gliomata, three were decidedly favourable, eight were not; of the astrocytomata, four were considered as favourable, while two were not. The oligodendrogliomata, although of a favourable type, were inconveniently situated within the ventricular system, and their removal was considered as problematical. The two ependymomata were of a favourable type; one was certainly irremovable, but the other might have been removed

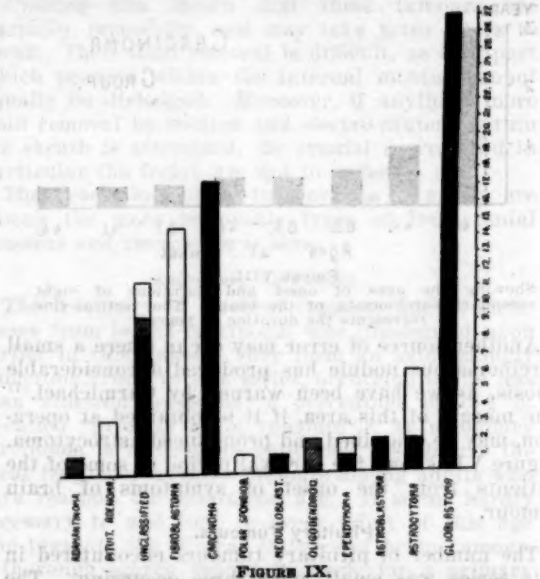

FIGURE IX.

An analysis of 87 cerebral tumours encountered above the tentorium. Those tumours which were regarded as favourable for operation within the meaning of this paper are indicated by the unshaded areas, those regarded as unfavourable by the darkened areas, and those regarded as doubtfully favourable are represented by the hatched spaces.

by a master. The medulloblastoma was unfavourable, but all the pituitary examples could be included in the favourable group. The 14 meningiomata were all regarded as being favourable in type, as was the one polar spongioblastoma; the one adamantinoma was considered as doubtfully favourable.

Of 87 tumours, we find 56 unfavourable or less favourable, 26 favourable, and five questionably favourable. When we observe that the 56 tumours represent two-thirds of the total number of tumours encountered above the tentorium, we realize how relatively unpropitious are the cerebral hemispheres as an operative field. Excluding the pituitary and suprasellar tumours, the surgeon depends for his success upon encountering a meningioma or one of the more organized types of glioma as the astrocytoma, ependymoma or oligodendroglioma.

Reviewing the 50 tumours of the subtentorial group, we find a much improved outlook. We must consider the eight medulloblastomata as unfavourable; the seven tumours of the pons and medulla were, on account of their situation, irremovable; the four carcinomata and two of three pineal

tumours could be similarly regarded. We then find eight astrocytomata, two of which could have been entirely removed, while the other six could have been removed to a greater or less degree. All of the five ependymomata were decidedly favourable.

We find then of 52 tumours encountered in this direction, 23 which could be regarded as unfavourable or less favourable, and 29 as favourable. We may therefore say that over 50% of the tumours of the posterior fossa offered excellent opportunities for operative interference. If we exclude the glioma

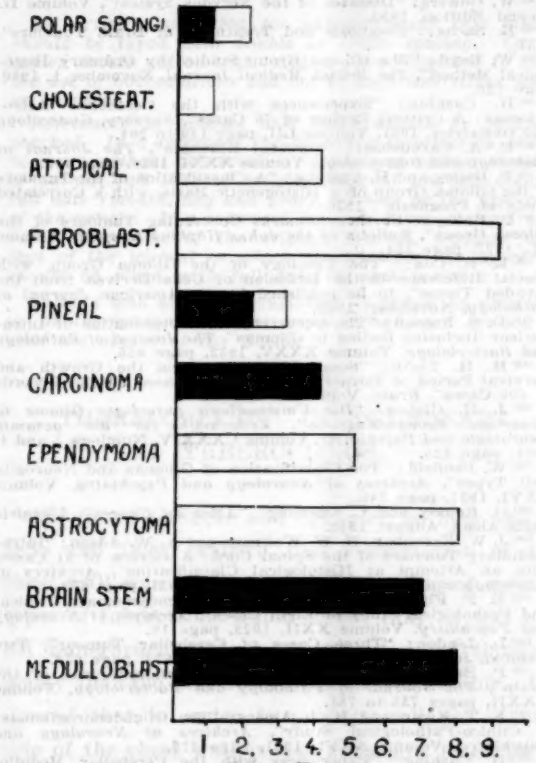

FIGURE X.
An analysis of 50 tumours of the brain encountered beneath the tentorium. The light and shade have the same significance in this figure as in Figure IX.

of the brain stem, upon which no operation for removal is suitable, and which may usually be diagnosed, two thirds of those tumours involving the cerebellum and cerebello-pontine angle were favourable.

The posterior fossa therefore offers a much better opportunity for successful surgery than the regions of the anterior and middle fossæ.

We may now consider the question as to how a decision based on clinical evidence is to be made as to the operability of any cerebral tumour.

(*a*) If the tumour be located above the tentorium, the chances are that it is unfavourable within the meaning of this paper; if below, that it is favourable.

(*b*) Of the supratentorial tumour, the pituitary tumours are usually of a favourable type. Owing to their peculiar situation, their relation to the optic chiasma, their influence upon metabolism and body structure, and the characteristic changes noted in the X ray picture, their diagnosis is not difficult.

(*c*) The rarer cranio-pharyngomata may also be easily diagnosed. Over 80% are calcified and visible in the radiograph. Although it is probably always wise to explore them, their total removal is difficult and usually fatal.

(*d*) The majority of the lesions of the cerebral hemispheres in this series were made up of glioblastomata and secondary carcinomata. If, however, a history of tumour for a period of two years or over can be traced, it will be found to be favourable in type in the great majority of cases; the one exception encountered in this series was an example of adenocarcinoma which had metastasized from a breast. Even with a history of over one year, a favourable type of tumour is likely. Thus the history of a convulsize seizure occurring some years previously may greatly encourage the surgeon and presage a type of growth which, if it can be removed, may take many years to recur.

(*e*) A history of a tumour growing within the cerebral hemispheres for several years, usually indicated a "meningioma". Many of these tumours show calcification, while a small proportion of them produce changes in the cranial bones which may be clearly visible in the radiogram. The astrocytomata are not uncommonly calcified, as are the ependymomata, while the majority of oligodendrogliomata show calcification. Calcification, therefore, indicates a favourable tumour type.

(*f*) Difficulty arises in the tumour with clinical history of under twelve months. Most of these, if the stage of general increase of intracranial pressure has eventuated, will be unfavourable. If one studies Figures III, VIA and VIB, it will be observed that many of the more favourable types have shown a brief history. Thus a simple cyst may produce a sudden alteration in the circulation and absorption of cerebro-spinal fluid, or a hæmorrhage, or sudden œdema may precipitate symptoms in a patient with a slowly growing astrocytoma.

In practice it is therefore wise to do a decompression operation over the site where a tumour is considered to be growing, even if a pessimistic view be taken of its nature. A simple decompression may be of great value, although the effects be brief. By an examination of the exposed brain there is less chance of being confronted at autopsy by a favourable tumour where an unfavourable one was diagnosed. In each of two cases in this series, an operation for carcinoma had been performed prior to the onset of cerebral symptoms. It was expected that the cerebral tumours would be metastases, but in each case a glioma was found at autopsy.

(*g*) Tumours of the cerebellum and cerebello-pontine angle are more likely to be favourable than not. In this situation the time incidence need hardly be considered; a tumour should be operated upon as soon as possible owing to the risk of sudden death, and every attempt made to remove it whatever the type. A rapidly increasing cerebellar syndrome in a young child is likely to be due to one

of the more malignant medulloblastomata; otherwise it is difficult to predict the nature of the growth.

(h) The angle tumours in this series all occurred in adults; they were, with the exception of a cholesteatoma and a meningioma, perineural fibroblastomata. When the symptoms and signs suggestive of angle tumours were observed in childhood, it was usually found that a glioma was present, either in the pons or growing into the cerebello-pontine angle from neighbouring parts. The cholesteatoma was an exception; for over twenty years prior to the onset of symptoms attributable to involvement of the cerebello-pontine angle, "wry neck" had been present. A cholesteatoma is a congenital tumour; it is quite likely that its presence may have been responsible for this persistent position of the head.

Summary.

1. The intracranial tumours derived from 135 patients have been examined and classified according to the modern classification; the percentage incidence of the various groups is compared with that of similar groups encountered elsewhere.

The frequency of secondary carcinoma as a cause of brain tumour in Victoria is commented upon; the present rarity of the large gumma and of the isolated tuberculoma is also noted.

2. The histology of the various groups is briefly described; it is suggested that certain of the modern names, based upon the appearances of embryogenesis, are not applicable.

The frequency of undifferentiated glioma types, as yet unnamed and unclassified, is commented upon.

3. The duration of growth of the various tumour groups, as estimated from the appearance of the first clinical sign until the death of the patient, or, in the case of the survivors, until the time of writing, has been investigated. The majority of the tumours conformed in this respect to the results obtained by other workers. Attention is, however, drawn to a type of cerebellar medulloblastoma of much slower growth than is usually recognized.

The rapid course of many of the astrocytomata arising in the cerebral hemispheres is contrasted with the slow course of those encountered in the cerebellum.

4. In reference to age incidence it was found that the slowly growing cerebellar medulloblastomata are by no means confined to early life, while several meningeal fibroblastomata were found to have arisen in childhood and in young adult life.

5. The operability of the various tumours is discussed. The generally favourable outlook of subtentorial tumours is contrasted with the unfavourable outlook of the tumours encountered above the tentorium.

6. Those indications which suggest that a tumour may be of a type favourable for surgical removal are briefly mentioned.

Acknowledgements.

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The Medical Journal of Australia

SATURDAY, FEBRUARY 10, 1934.

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THORACOPLASTY IN PULMONARY TUBERCULOSIS.

ALTHOUGH Quincke and Spengler, as long ago as 1888 and 1890, realized that mobilization of the chest wall was necessary for the healing of certain types of tuberculous lesion in the lung, it was not till Sauerbruch devised his operation of thoracoplasty that the best results became attainable. He showed that in order to produce collapse of one side of the chest wall it was necessary to excise a portion of almost all the ribs on that side, and that the portion of the rib removed had to be as close as possible to the spinal transverse process. Before Sauerbruch devised his operation, that bearing the name of Brauer and Friedrick was generally used. In this operation a portion of the first eight ribs was removed from the back and parts of the costal cartilages of the first five ribs were removed from the front. It is quite obvious that more satisfactory collapse will be obtained with the Sauerbruch than with the Brauer-Friedrick operation. But the operation of thoracoplasty is an extensive one and it is likely to be attended by a good deal of shock. Unless, therefore, the indications for its use are clearly defined, and unless it is performed by an expert, the mortality is likely to be high, and the patient who recovers may be little, if any, better off for all his pain and tribulation.

A discussion on thoracoplasty is appropriate in view of a recent communication by Dr. J. J. Wiener and Dr. Maurice Fishberg.[1] These two observers, in reporting forty-four cases in which thoracoplasty was carried out, are careful to point out that their patients came from two institutions, one in which patients in early stages of pulmonary tuberculosis are treated, and one in which the patients are in the late stages. They also state that the ideal patient for thoracoplasty is one with a unilateral lesion tending to sclerosis with mild or but slight symptoms of progressive disease. Nearly all their patients had been subjected to artificial pneumothorax therapy. In some instances this was successful in ameliorating the symptoms, but sooner or later had to be abandoned because of pleural effusions, obliterative pleuritis and similar conditions. Sometimes the patient apparently recovered, but had a relapse, and attempts at reinduction of pneumothorax proved futile. In view of the conclusions stated by Wiener and Fishberg, it is important to consider the types of patient submitted by them to thoracoplasty. They divide their patients into several groups. The first are called active parenchymatous cases. Under this heading the histories of twenty-six patients are given, with the *post mortem* notes in several instances. The most important conclusion arrived at is that thoracoplasty does not cause collapse of lung cavities, but at most reduces their size "more or less". Eight patients were submitted to operation on account of repeated hæmoptyses. The histories of these eight persons is a dismal record. Bleeding was lessened, but not controlled, and the disease continued its course. Ten patients were operated on because of pyopneumothorax. In six instances the pyothorax followed the induction of artificial pneumothorax. The conclusions of Wiener and Fishberg are against the adoption of thoracoplasty. They point out that as a rule the patient chosen for thoracoplasty has a chronic infection and that this patient

[1] *Archives of Internal Medicine*, September, 1933.

is apt to live for many years and to be able to pursue his occupation under conservative treatment. They state their belief frankly that, had they cared for these forty-four patients along tried and conservative lines of treatment, or had they allowed them to drift without treatment, the final results would have been much better. They have not observed a patient who, when seen several years after a thoracoplasty operation, was as free from symptoms of tuberculous disease as were patients seen by them following the institution of climatic or institutional treatment, with or without artificial pneumothorax.

In any attempt to compare results in such a matter as that under consideration, it must be remembered that results depend largely on the type of patient chosen for treatment, on the way in which the operation is performed, and on the type of anæsthesia used. Moreover, the criteria of improvement of different authors may not be the same. Wiener and Fishberg may have been unfortunate in their choice of patients; they may have expected too much as a result of operation. Even if due allowance is made for varying factors, their results differ considerably from those of other writers. Bull, for example, reported a mortality of 11% after thoracoplasty. Of 200 patients operated on between the years 1914 and 1929, 129 were living when he wrote in 1931, and 87 of these were regarded as cured; 67 were dead and four could not be traced. The present purpose, however, is not to discuss the work of Wiener and Fishberg as such, but to use their findings as emphasizing the difficulty of the subject. Very little work of this kind has been reported in Australia. Those who propose to undertake thoracoplasty in the treatment of pulmonary tuberculosis must remember two things. The first is that the indications for operation must be sound; the second is that the operator must be expert. The chief indication will be the presence of a well localized sclerotic cavity on which artificial pneumothorax has had no effect. It may sometimes be advisable to follow Schedtler, who advises thoracoplasty in some cases when effusions arise during pneumothorax treatment, when residual cavities or pyopneumothoraces cannot be closed by any other means, and in serious hæmoptysis when artificial pneumothorax induction is ineffective. As far as the expertness of the operator is concerned, it should be stated most emphatically that thoracic surgery is a highly specialized branch of the art. It may perhaps be ranked in this regard as equal to neuro-surgery. Satisfactory results will be gained in thoracic surgery only by a man who is prepared to devote much care and study to the subject.

Current Comment.

PNEUMOCOCCAL EMPYEMA.

THE ideal method for the treatment of empyema has not yet been devised. The existence of two so widely differing methods as open drainage (fortunately now fallen largely into disuse) and aspiration with air replacement is sufficient to indicate that little is actually known concerning the basic therapeutic requirements. It is logical to remove the pus or to allow it to escape; but this alone does not effect a cure; in recovery from empyema, as from other septic diseases, natural processes play the most important part. The ideal method would be one combining rapid removal of the pus with rapid destruction of the causal bacteria or a rapid strengthening of the bodily defences with the same object, and provision for the rapid reexpansion of the lung. Modern methods are discussed by R. B. Wade and H. S. Stacy in papers appearing in this issue.

One of the more recent procedures in the treatment of pneumococcal empyema consists in the aspiration of the pus and the injection of a solution of sodium taurocholate into the pleural cavity; it has been employed by A. P. Thomson.[1] The method was described by Cocchi in 1931; but this was unknown to Thomson when he commenced his work.

Pneumococci are soluble in bile, and cultures of pneumococci are made sterile by the addition of a 2% solution of sodium taurocholate. Thomson determined to apply this knowledge clinically. At first he used sterile bile, injecting very small quantities only, in view of the possible danger of toxic effects from the bile itself or from the solution of pneumococci. Later he employed a 20% solution of sodium taurocholate in much larger amounts. He states that a child suffers no ill effects from a dose of twenty cubic centimetres.

Briefly, the technique is as follows. Twenty cubic centimetres of a 20% solution of sodium taurocholate are injected into the pleural cavity on alternate days until the pus is sterile or there is a feeble growth only of pneumococci on culture. A convenient (*sic*) quantity of pus is aspirated before

[1] *Proceedings of the Royal Society of Medicine*, October, 1933.

each injection. A fine trocar and cannula should be used in preference to an exploring needle, as the latter is apt to punch out a small piece of skin and carry it into the pleural cavity, with the risk of secondary infection.

Thomson has treated six children on these lines, with satisfactory results in four instances. The two failures were due to secondary infection with *Staphylococcus aureus*, which, Thomson believes, was introduced with an exploring needle. In one case a widespread rash similar to a measles rash appeared; but it was accompanied by no untoward symptoms.

Sodium taurocholate is valueless in the treatment of streptococcal infections; but it may be of value in the treatment of pneumococcal infections of parts other than the pleura. Thomson found that pneumococcal arthritis subsided rapidly after the injection of a 2% solution into the affected joint. He suggests that pneumococcal meningitis might be similarly dealt with.

The results obtained by Thomson are not convincing proof of the value of sodium taurocholate, as the series of cases was too small. They provide stronger evidence when they are considered alongside of Cocchi's report, of which they may be said to be confirmatory. The important feature of the method is its logical evolution from sound biological data. The least that can be said of it is that it is worthy of a more extended trial. At the same time it may be used in other pneumococcal diseases, such as pericarditis and meningitis. As long as it holds out a hope of curing either of these two highly lethal diseases any reasonable measure demands careful investigation.

TUBERCULOUS INFECTION IN MILK.

ALTHOUGH we have reason for believing that the problem of the infection of milk by bovine tubercle bacilli does not assume the same serious proportions in Australia as in some other parts of the world, it is not negligible. Moreover, there is still a certain influx of immigrants into this country; the current has been greatly slowed down by the economic depression, but will no doubt reach greater volume once more when happier conditions prevail. For these reasons, as well as the obvious scientific interest that all should have in the many and wide ramifications of a disease so protean as tuberculosis, it is worth perusing a report by the Department of Health for Scotland on tuberculous infection in milk.[1] The inquiry that supplied the material for this report was designed to ascertain the extent of tuberculous infection in the more populous areas of Scotland. The centres responsible for carrying out the investigation were Aberdeen, Dundee, Edinburgh and Glasgow. By collaboration with the local authorities expert bacteriological help and opinion were available in each centre, and a standard technique and procedure were adopted. The milk tested included raw milk arriving in the city areas in churns, heat-treated milk, random samples as sold over the counter to the public, and special graded milk, for example, from tuberculin-tested herds. Duplicate samples were centrifuged and the sediment was inoculated into guinea-pigs. The experimental animals were killed, one of each pair at the end of four weeks and the other immediately if the first was found to be infected, but after the lapse of another month if the first animal was apparently uninfected. The tuberculous nature of any suspicious lesion was confirmed by microscopic examination and, if necessary, by cultural and reinoculation tests. One point of interest is that if a method had been used by which the examination of one guinea-pig only was carried out only four weeks after inoculation, over one-third of the positive cases would have been missed. The need for caution in interpreting the results of tests that fail to reveal tuberculosis is, of course, well recognized here and, in fact, some believe that many of the local breeds of guinea-pig are somewhat resistant to infection.

The general results obtained were as follows. The raw milk as delivered to the four chief Scottish cities showed tuberculous infection to the extent of 10%. Where creamery bulked milks were examined the percentage rose to thirty and over. This is to be expected, for the number of individual samples in a given volume is here very high. Heat treatment reduces the incidence of infection to a very considerable degree; the actual percentages varied rather widely, according to the methods used, but the value of heat, pasteurization or similar process was evident. The milk retailed to the public was in general infected to the extent of about 5%; this refers only to the ordinary grades of milk, for the certified grades were found to be free from infection.

This report is of great interest, as it confirms the need for the protection of the public. The subject of milk distribution is arousing attention recently in Sydney, and there can be no doubt that in the past rather haphazard methods of milk distribution have prevailed in most parts of this country. Milk is a food well nigh universal; it is also an important factor in the spread of disease. Although it is not claimed that the conditions in Australia are at all comparable with those prevailing in Scotland, the moral is clear and should be practically applied. With regard to tuberculous infection, it should be remembered that rigid inspection and testing of herds can remove the danger altogether, and even simple heat treatment of the milk before it is retailed to the public can do a great deal towards making it safe as a food. In a subsequent issue attention will be drawn to another of the special reports of the Medical Research Council, in which there is a report of experimental investigations into the eradication of tuberculosis from herds of cattle.

[1] A report by the Department of Health for Scotland, issued by the Medical Research Council, Special Report Series, No. 189.

Abstracts from Current Medical Literature.

BACTERIOLOGY AND IMMUNOLOGY.

Peptone Culture Medium.

HEDLEY D. WRIGHT (*The Journal of Pathology and Bacteriology*, September, 1933) records the results of a study of the preparation of extracts and broths based largely on Huntoon's observations. Details of the methods employed are given in full, including the estimation of the value of each medium, the inoculum, the method of recording results and the media prepared. The nutritive value of meat extracts prepared by different methods was investigated. It was noted that the effect of the reaction at the time of coagulation was slight. Extraction by simmering seemed to yield good extracts rather more constantly than extraction by infusion overnight. Veal was found to yield more satisfactory extracts than ox heart or ox liver, and was found to vary less from one experiment to another. Freshness of the meat employed did not seem to be of importance, as no difference was detected between extracts prepared from meat killed less than twenty-four hours and those made from the same meat stored for a week in the refrigerator. Sterilization by filtration through a Zeitz disk immediately after the first steaming was found to yield slightly better extracts than those exposed to routine steamings and ten minutes' sterilization at ten pounds pressure. Sterilization by steaming for thirty minutes on each of three days was not found to have any advantage over autoclaving for ten minutes at ten pounds pressure. Paper filtration was not found to be less effective than filtration through glass wool. The value of nutrient broths prepared by different methods was also investigated, and the results indicated that these, like the extracts, were little influenced by any of the various modifications in procedure noted above. The important factor noted was the time of the addition of the peptone to the other constituents of the media. The author proved that peptone requires adequate reduction, and this is most readily obtained by the addition of the peptone to the other ingredients before any heat is applied, so that it may be exposed to the powerful reducing action of substances in the meat or meat infusion during the process of steaming to coagulate the proteins. The method recommended as most satisfactory for preparing broth for the growth of pneumococci (the organism used in the experiments described) is as follows: To one litre of distilled water add ten grammes of peptone, five grammes of sodium chloride and five hundred grammes of meat, preferably veal, finely minced after removal of excess of fat. Mix well and heat for twenty minutes at 68° C., stirring at intervals. Shake well and steam in the steam sterilizer for thirty minutes, filter through paper and adjust the reaction to pH 7·8 to 8·0. Again steam for thirty minutes and filter through paper. Check the reaction of the filtrate (pH 7·6 to 7·8) and add 1·5 grammes of glucose per litre. Distribute as required and sterilize by autoclaving for ten minutes at ten pounds pressure.

Anaerobic Methods for the Identification of Hæmolytic Streptococci.

R. M. FRY (*The Journal of Pathology and Bacteriology*, November, 1933) draws attention to the importance of anaerobic cultures as a routine method of isolation of hæmolytic streptococci. In certain cases it was observed that a typical hæmolytic streptococcus was isolated, usually from the blood or uterus, while from some other focus of infection a strain was recovered which in aerobic cultures on horse blood serum showed no trace of β-hæmolysis. In anaerobic cultures well marked β-hæmolysis was developed and the colonies were indistinguishable from those of the original strain. When tested for soluble hæmolysis production, twelve to eighteen hour cultures in broth containing 10% horse serum being used, the green strains in every case gave a positive result. One strain isolated from a cervix was originally a pure hæmolytic one; after passage *in vitro* through human blood it acquired the characters of the green forms. These forms remain green on aerobic culture, and become strongly hæmolytic on anaerobic culture. The author suggests that it is of fundamental importance to grow cultures under anaerobic conditions when isolation of hæmolytic streptococci is attempted. As a fairly satisfactory substitute for anaerobic cultures it is only necessary to dig the platinum wire into the medium when spreading out the inoculum. The partial anaerobiasis produced in the depths of the medium is usually sufficient for hæmolysis production.

The Filtration of Spirochætes Through Graded Collodion Membranes.

E. HINDLE (*The Journal of Pathology and Bacteriology*, July, 1933) records the results of an investigation into a comparison of the relative size of spirochætes by estimating their capacity to pass through graded collodion membranes. The method of preparing the membranes and assembling the ultra-filter was that of Barnard and Elford. The filtration was mostly carried out in a temperature of 37° C. and a pressure of seventy-six centimetres of mercury was obtained by use of a cylinder of nitrogen. The quantity filtered was approximately ten cubic centimetres per centimetre of membrane, and the filtrate was examined both microscopically with dark ground illumination and by making cultures of various dilutions. Two strains of common water leptospira (*Spirochæta biflexa*) were used, one strain of *Spirochæta icterohæmorrhagica* isolated from a London sewer rat, and two strains of *Spirochæta pallida*. The latter were grown in a mixture of 10% rabbit serum and 90% Hartley's broth containing a piece of rabbit liver in each tube. The tubes of medium were heated at 56° C. before use and then after being inoculated with the spirochætes were covered with vaseline and incubated at 37° C. The cultures reached their maximum growth after about five days. It was found the *Spirochæta pallida* had a limiting porosity of about 0·4μ. This is interpreted as indicating a diameter of 0·2μ. The spirochætes pass readily through the filter and the method furnished a simple and effective means of separating spirochætes from other organisms.

Moniliasis with Meningeal Involvement.

LAWRENCE W. SMITH AND MACHTELD E. SANO (*Journal of Infectious Diseases*, September-October, 1933) record a case of moniliasis associated with involvement of the meninges. The patient was a boy, aged twenty-two months, with a history of illness for two weeks. He was acutely ill with high temperature, rapid pulse and loose patchy white membrane on the buccal mucosa, under-surface of tongue, uvula and pharynx. Smears of this material showed an organism with the morphological characteristics of oidium or monilia. The cerebro-spinal fluid showed clouding after forty-eight hours and microscopic examination revealed organisms of the same appearance as those obtained from the lesions in the mouth. Details of the progress of the case are given, and eleven days after admission death occurred. At one stage bilateral *otitis media* developed, and hæmolytic streptococci were recovered from the blood. Just before death, a marked right internal strabismus developed, followed by severe convulsion. At autopsy the same organism was recovered from the ileum and the base of the brain, and in association with a hæmolytic streptococcus from the blood, middle ear and mastoid. Though presenting certain minor cultural, fermentative and serological variations, the organism was classified as *Monilia albicans*. It was proved to be highly pathogenic to rabbits and in these animals produced invariably on intravenous inoculation a definite meningitis as well as focal lesions in the brain.

HYGIENE.

Loss of Actinic Sunshine as a Health Problem of Cities.

F. O. TONNEY (*American Journal of Public Health*, August, 1933) states

that pollution of the air by products of combustion has been treated primarily as of economic and æsthetic concern rather than as a basic health problem. The obscuring effect of smoke reduces the intensity of the antirhachitic and erythemal rays, especially in the winter. In Chicago (1931) 16% of pre-school children showed visible rickets. Coons found a negative calcium balance in six out of nine expectant mothers; thus the baby must draw on the mother's structures for its calcium and may go short itself. The needs of lactation of the teeth and the effect on resistance to infection are mentioned. Respiratory death rates ebb and flow corresponding to the actinic rise and fall, and the ultra-violet light deficiency is a factor in cold-susceptible persons. Erythemal time was recorded by tests on children. The child was placed in direct sunshine for forty to fifty minutes. It was stripped to the waist, its shoulders were covered with a cloth and an opaque strip with openings was fixed to the exposed abdomen with paper stickers. Exposures of five, ten, fifteen minutes *et cetera* were made up to fifty minutes, and after twelve hours the erythemal spots were counted. The number of visible spots subtracted from the total openings exposed and multiplied by five gives the minimal erythemal time. This in Chicago in June was twenty minutes in both children and adults between 12 midday and 1 p.m. The daily estimate at the same time was made of the actinic value by the reduction of oxalic acid. The curves given show that in January, 1932, no day reached more than 250 milligrammes, the average being about 100, much below the threshold of erythema (= 350). In July, 1932, the actinic measure reached 712, with an average of about 500, being above the erythemal threshold almost every day. Climatic surveys of cities, education of urban populations in the health value of the out-of-doors, the provision of ultra-violet lamps and cod liver oil for infants in the overcast season are suggested, together with the provision of heat without pollution as by gas and electric power. What is needed is pure water for all—the unthinking as well as the informed; safe milk for all; clean air and the full actinic value of sunshine at all seasons of the year for the entire population.

The Mechanism of Lead Poisoning.

A. SCHRETZENMAYR (*Deutsche Medizinische Wochenschrift*, October 20, 1933) writes on the mechanism of lead poisoning and describes an acute case. Straub and Erlenmayer established the fact that only the lead which is for the time being circulating in the blood produces symptoms, while that in the depôts—the liver and the osseous system—so long as it remains stored there, is harmless. The American authors Aub, Fairhall, Minot and Retzikoff confirmed this and further demonstrated a connexion between the storage of the lead and calcium metabolism. Calcium intake through diet or medicine favours such storage; calcium abstraction releases the poison into the blood. This release is aided by potassium iodide and other drugs. Hereby is indicated the treatment to be followed in lead poisoning. In chronic poisoning, decalcifying diet and potassium iodide gradually empty the depôts and remove the poison from the body. In colic, on the other hand, which is considered as due to acute release of depôt lead into the blood, increased calcium intake drives the circulating lead back into the depôts. Clinically this theory is confirmed, and especially by the fact that lead colic is rapidly relieved by an intravenous injection of calcium. The "specificity" of this calcium effect is, however, open to question, since colic from other causes is benefited by calcium. The author gives details of a severe case of acute lead poisoning in which the above theories were usefully applied in treatment. A woman, aged twenty-two years, five months pregnant, had no ill health till three weeks before her admission to hospital on October 1, 1932, when she suddenly developed abdominal pain, nausea and continuous vomiting, and later constipation, exhaustion, and finally "paralysis" of both lower limbs. The symptoms increased in severity and eventually a diagnosis of acute lead poisoning was made. As the state of the kidneys precluded any hope of improvement by excretion of the lead, the indication was to drive the lead out of the blood into the depôts and thereby render it harmless for the time being, in other words, to convert an acute lead poisoning into the chronic form. Accordingly, she was given abundance of milk and a daily intravenous injection of 10% calcium gluconate. From the first day the result of this treatment was convincing and the condition of the patient improved steadily. Acute lead poisoning is a very rare condition. Other than homicidal or suicidal the cases have been mostly women who have taken litharge as an ecbolic. The details of these cases show how great are the variations of human tolerance of lead. Evidence of this is found in the rarity of acute cases despite the widespread present day use of litharge as an abortifacient. In the recorded cases the severity bears little relation to the amount of poison taken.

Tuberculosis in Urban and Rural New York.

ELIZABETH PARKHURST (*American Journal of Public Health*, September, 1933) has, during the three years 1929-1931 (mid-census year 1930), given special attention to determining the residence of persons dying from tuberculosis in New York and to the prevention of distortion from hospital or sanatorium groups. The recorded and adjusted rates for 1931 were as follows: New York, city, 69·4 (adjusted 76·5); New York, rest of State, urban 48·1 (adjusted 61·1), rural 72·7 (adjusted 44·6). The male and female total rates were distinctly lower for females and for rural areas: City, 97·6 male, 62·2 female; urban, 76·2 male, 53·7 female; rural, 55·5 male, 46·2 female. The age-sex mortality shows a very similar curve in females, though somewhat higher in New York City. The typical peak is shown at twenty-five to thirty years of age. The male curve in rural areas shows a similar peak at thirty to thirty-five, though the level is equally high at 75. A marked difference appears in the city dwellers, the curve rising rapidly to a peak at fifty-five years, 160% greater than the rural figures—a definite occupational effect. These differences persist after age, colour and nativity are considered. The death rates among negroes in the rest of New York State were four times greater for males (283 to 65) and five times greater for females (236 to 48). Among the white population the native-born of native parentage showed the lowest mortality, 45·0 males, 39·3 females (corrected for age differences); native-born of foreign parentage, 82·3 and 56·5; foreign-born, 80·9 and 50·9. Amongst the last mentioned group the English-speaking group, Ireland—108 Irish and 114 first generation—exceeded British 62 and 58·5 and Canadian 57 and 55·3. Italy produced the best results of foreign-born compared with races in central Europe—Italy 57·5 and 36·6 as against 100·2 and 59·3 for central Europe.

Xerophthalmia and Night-Blindness in the United States.

A. F. HESS AND D. B. KIRBY (*American Journal of Public Health*, September, 1933) write that on inquiry from forty-one eye specialists in the United States of America, only eight recorded cases of night-blindness could be collected. This inability to see in the dusk or night owing to lack of dark adaptation is perhaps the earliest and most sensitive test of vitamin *A* deficiency, for this vitamin causes the visual purple to regenerate slowly. The normal retina is richer in vitamin *A* than is butter. Drunkards are especially susceptible to vitamin *A* deficiency. Though this deficiency is rare, it has increased during the economic depression.

CORRIGENDUM.

On page 132 of the issue of January 27 there appeared an abstract on ophthalmology entitled "Evisceration". An error has occurred in the last sentence of the abstract, which reads: "Enucleation is also contraindicated when tumour is suspected . . ." This sentence should obviously read: "Evisceration is also contraindicated when tumour is suspected."

Special Articles on Treatment.

(Contributed by request.)

XXVI.

THE TREATMENT OF BUNIONS.

EVERYONE knows, vaguely, what is meant by a "bunion", but no one seems able to define the word with precision.

Is it the knob at the base of the big toe, or is it the distorted big toe itself, or is it either, or is it both? A moment's self-examination will show up a certain indefiniteness on this point. Nor will an appeal to the dictionaries clear up the matter entirely. It is rather quaint to find even the philologists in difficulties over the derivation of the word, one guessing it comes from the Latin, one from the French, and one from the Italian, and the originals to have meant a "bun", a "boil", and a "botch", respectively.

For the purposes of this writing a bunion is a pathological metatarso-phalangeal joint of the great toe, and the term includes its enlargements, its distortions, its pains and its stiffnesses; for all these factors mingle and cannot always be dissociated.

One pauses to wonder whether one of these enlargements, namely, that due to an inflammation of the bursa over the head of the metatarsal, is not what is really and properly meant by the term bunion and whether we should not restrict its use to this condition alone and deal with the others under the headings of *hallux valgus*, arthritis and *hallux rigidus*. Such limitation might be academically desirable; but for anything useful to be written on the treatment of bunions one must take and use the definition already laid down.

Someone has counted twenty-six different described operations for the surgical cure of *hallux valgus*. This means that surgeons are seeking new ways in order to avoid the failures of the old ways. A teacher of vast experience has said: "Anyone who attempts the operative treatment of *hallux valgus* light-heartedly is going to be disappointed." I have no doubt that if one were to ask any busy chiropodist to undergo a surgical operation on his big toe joint he would hesitate a very long time before consenting. Difficulties do exist, and I warn anyone perusing this in the hope of finding a safe, simple and infallible remedy for all bunions, that such is not forthcoming. But an effort will be made to reduce the operations deemed necessary to three, and to describe the indications for them. Before proceeding to do this, I might say a word about the causes of the difficulty and non-success in this undertaking. Curiously, although there are twenty-six operations described, there has been a tendency on the part of surgeons for each individual to adopt one operation, which he proceeds to perform in all cases of bunion. The great toe would appear almost to resent such cavalier treatment and would remind us that its present importance, as well as its past history and its future destiny, entitles it to more careful consideration and respect. At present it outweighs in importance and strength all the other toes put together. Think how it forms the apex of an inverted pyramid of powerful muscles. The *tibialis anticus* and the *peronæus longus* are attached to the first metatarsal bone almost exclusively, and the *tibialis posticus* largely. There are the *extensores* (*longus* and *brevis*) in front, and the *flexores* (*longus* and *brevis*) behind, and the strong abductor and several good adductors at its sides.

Half in number, and in substance more than half, of the muscles of the lower leg proceed to an insertion into the big toe unit. In the act of walking, this unit, at the final one-third of each step, becomes a fixed point, and the whole of the body weight is supported and propelled forward by these large muscles. No operation should be devised without having this pyramid of muscles in mind. Its consideration, too, will point the way to wearing foot-gear that allows the big toe to remain straight and show how ineffective will be any of the devices that interpose spongy rubber between the first and second toes for the correction of *hallux valgus*.

As to the past of the great toe, there are frequently seen cases which remind us that we had an ancestor whose great toe was used for grasping in the same way as is our thumb today. These occasional reversions make themselves shown in one of three ways: either the first metatarsal bone diverges sharply away from the others (*metatarsus primus varus*), or it is very short in relation to the others, thereby making the second toe appear easily the longest in the foot (*metatarsus atavicus*), or thirdly, the tarso-metatarsal joint is hypermobile. These three conditions are by no means rare, and they demand attention in planning operation. Finally, as to the future of the great toe, it would appear (*vide* a certain glass case in the museum of the Institute of Anatomy at Canberra) that the tibia, the great toe and the second and third toes have been selected by Nature to carry on foot function more and more, while the fibula and the two outermost toes are showing a tendency to disappear.

Examination.

He who would deal adequately with a patient suffering from bunion must look not only at the bunion itself. This, indeed, he must study intently, seeking the cause of complaint and the classification of the particular case; but he must also observe the foot as a whole. It is of little avail to straighten the big toe if we leave untouched an imbalance of the foot in relation to the leg, which helped the formation of the bunion and will, if uncorrected, help its recurrence. And one must choose an operation sometimes which differs according to whether the patient is a waitress or a wealthy widow with a Rolls-Royce car. Nor is it any use doing anything to anybody unless it is clearly understood by all parties that properly designed footwear must be used, even after the operation.

People, as a rule, put up with their bunions until pain begins to become persistent and important. Then, with considerable misgiving, they seek medical advice. This is a step of some gravity; since each one has heard of someone who has had an unsuccessful operation for bunion. It is up to the doctor to recognize the gravity of the case and to begin a thorough search for the cause of the pain.

On inspection he will observe the general appearances round the metatarso-phalangeal joint, looking for general or local enlargements, for distortions, for discolorations, callosities and corns. The whole joint may be enlarged evenly, with or without deformity of the toe itself. Local enlargements may be found on palpation to be due to underlying osteophytic overgrowth, either dorsally or laterally, or to gouty tophi. Sometimes the complaint of pain may be confined to a lateral osteophyte whose removal alone would suffice for relief. Or the enlargements may be soft, as in chronic inflammation of the bursa that forms medially over the head of the metatarsal, or of the nature of a ganglion forming dorsally.

Discolorations are mostly due to local hyperæmia of the soft tissues, produced where shoe pressure from without encounters abnormal overgrowth within. Callosities and corns may appear in various positions, and each tells its own story of pressure. For example, there is the longitudinal ridge along the median underside of the great toe, produced by the rolling action of a valgoid foot, and there is the special horniness, with perhaps an infected bursa beneath it, which comes under the head of the metatarsal in cases of early claw feet, with shortening of the plantar fascia.

The inspection will now concentrate on the deformity of the toe in relation to the metatarsal bone. Sometimes an anxious parent brings a twelve-year-old child with slight early *hallux valgus* deformity; such a case is best dealt with by over-correcting in plaster of Paris for six weeks followed by exercises and correct shoeing. At other times one is confronted with the completely subluxated joint, the big toe either overlapping or under-

lapping the second toe, or the second toe assuming the position of hammer-toe, in order to get out of the way. Between these extremes are all grades of deformity; but the cases that demand operative treatment for correction are those in which the *extensor longus hallucis* has pulled away from its normal position in the mid-line of the metatarsal head and comes to form one side of a triangle of which the phalanx and the metatarsal form the other sides. Once this has occurred, every time the muscle acts it will tend to increase the deformity.

Note whether the first metatarsal is roughly parallel or grossly everted from the others. If so, osteotomy will be indicated.

Note whether, like Larwood's, the symptoms of pain in the big toe joint are associated with a very short metatarsal, in which case one would be very loath to shorten the toe further by excision of the bone.

Then test the mobility of the joint, noting any complaint of pain associated with movement. If all movements are limited and painful it is a sign of arthritis. In extreme cases ankylosis has taken place (*hallux rigidus*). Then test the joint for signs of arthritis, by a sharp nip between the thumb and the forefinger, delivered obliquely through the interarticular space. If this brings forth a sharp complaint of tenderness, then arthritis is present. Confirm by rotating the toe; this also causes great distress in arthritis. If the arthritis is acute, the joint will feel hot.

Then have an X ray examination made of the joint. This will show more clearly any atavistic variations; and if these are present, the second and third metatarsals show, by their increased size and density, how they have been doing extra work. As to the joint itself, one looks for the width of the interarticular space; for the presence of osteophytes, their size, shape and placing; and for bony enlargement of the metatarsal head, with osteoporosis and perhaps the formation of bone cysts. In passing I may mention here that a cyst in the head of the metatarsal often causes pain and is relieved by drilling the head in various directions with a fine bone drill.

Then take a look at the foot as a whole, asking yourself whether it is capsized, splayed or valgus—the three degrees of eversion imbalance which are all associated with flattening of the longitudinal arches (that is, flat foot) or whether the *tendo Achillis* is unduly short, any one of which conditions, if present, would deprive us of success after operation unless it, too, were corrected.

The Operation.

The choice of operative procedure hangs upon the question: how much arthritis is present? Has the joint the power to recover if given rest, or has the destruction of the joint reached a point from which restoration cannot be expected? Manifestly, in *hallux rigidus* it has; and in the cases where joint movement is free and painless, no matter how deformed the big toe is, it has not. Patients with gross enlargement of the whole joint, pain on every movement, sharp pain on nipping and on rotation, loss of interarticular space (as seen by X rays), whose joints, when opened, show red, bare erosions or pannus, may be regarded as beyond recovery. In these cases excision of bone and formation of a new joint is called for. There are two ways of performing this arthroplasty, each with its advantages in certain cases. One is to cut away generously the base of the first phalanx (Kellar's operation). The other is to cut away generously the head of the first metatarsal bone (Mayo's).

Using a tourniquet, one makes a J-shaped incision, so placed as to give access to the selected bone. The metatarsal head is completely removed by chiselling through the neck close to the head; or the phalangeal base is removed after chiselling through the shaft at its middle point. No inturned flap is required. In Kellar's operation take great care not to cut the *flexor longus hallucis* tendon. The wound is sewn up and bandaged with flakes of absorbent cotton between the turns of bandage, and then the tourniquet is removed. Early walking, in from ten to fourteen days, is necessary. Either operation may be performed under local anæsthesia, and if one foot at a time be done, very little invalidism results. Any attempt to combine the two operations is inimical to success. If the phalanx is being cut, the metatarsal must remain untouched, and *vice versa*. Even to remove an osteophyte from the neighbouring bone is to open up the way for a bony bridge to form later on; and this will or may occur even if flaps are neatly stitched over the cut bone. In general, the younger the patient, the more inclined one would be to do the phalangeal excision; for the older person, and especially those who can "take things easy", the excision of the metatarsal.

Suppose, however, there are some contraindications, either subjective or objective, to the performance of any operation at all. Happily, we can fall back with confidence, as far as the relief of pain goes, on Thomas's metatarsal bar. Place this, not as is usually done, directly under the transverse line of the metacarpo-phalangeal joint, but definitely just behind that line; make it 2·5 centimetres (one inch) broad and 1·25 centimetres (half an inch) high for a man. Then cut away the upper of the shoe completely forward of a line corresponding to the bar beneath. Unfortunately this is a conspicuous state of footwear, so one has sometimes to compromise by asking the shoemaker to cut out a patch of the upper over the bunion and to cement in a puffed patch of similar leather at this site.

How best now to tackle those cases in which the signs of joint damage are not severe, those in which the ugliness of the distortion is the main factor that brings the patient. Osteotomy comes to our aid. Especially suitable for osteotomy are the congenital *metatarsus primus varus* cases. In this condition the wearing of any shoes, no matter how well designed, will bring about *hallux valgus* and will make it recur after any type of operation but osteotomy. The simplest method is to open to the bone at the base of the metatarsal and drive an osteotome obliquely through the shaft near its base and then crack the bone into a corrected position. After sewing up, apply a good broad band of adhesive plaster to keep the first metatarsal parallel with the others. If one foot is operated on at a time, walking at the end of three weeks, with a common metal arch support as a splint, can be allowed; but if both feet are operated on at the same time, walking should be delayed until the sixth week.

But suppose there is severe *hallux valgus* with a good mobile joint and no *metatarsus primus varus*. In these cases plastic surgery round the joint gives the best result.

The method I prefer is to make a J-shaped incision and dissect up a good subcutaneous flap with its base distalward, consisting of the bursa and the thickened joint capsule. If the bursa be found to have thickened, unhealthy walls, it had better be excised. This should be done in all cases when recurrent bursitis has shown up in the picture. It is good and sufficient treatment in itself for those cases in which symptoms of pain are confined to this bursa. Dissect the flap by short knife cuts, keeping close to the bone. Expose the medial side of the head of the first metatarsal bone, which is here overgrown in response to shoe pressure, and cut away a good slice of it; then with a fine tenotomy knife cut the shortened lateral capsular ligaments of the joint and tenotomize the *extensor longus hallucis*. Next, dissect out the tendon of the *abductor hallucis*, which runs through the capsule very low down on the medial side, and detach this from the under side of the base of the first phalanx. After anchoring the tip of the capsular flap, reattach the tendon of the abductor with silk into a groove made with a gouge in the first phalanx 1·25 centimetres (half an inch) further round the periphery of the joint, at such a point and at such a tension that the transplanted tendon acts as an efficient internal splint, and, when healing has taken place, it acts beneficially, both by straightening the toe in an active manner and by helping to push the head of the first metatarsal over into line with the other metatarsals.

After-Treatment.

As after-treatment I employ an aluminium *hallux valgus* splint for three weeks. Afterwards adhesive plaster suffices to maintain the position. Walking in shoes cut away or, better, in a cloth-topped convalescent shoe of the correct design, may be then allowed.

Subsequently all patients are instructed to digitate the hosiery so as to give the great toe a special compartment to itself, and to wear shoes which inswing the foot and allow ample vertical room over the great toe joint, and to bring back the musculature of the great toe into strength and activity by exercises superintended by the masseuse.

The shoes required need not be and should not be conspicuously "orthopædic" or clumsy. They can be made to be made to appear quite smart and elegant. This seems a small point; but without its satisfactory settlement few women would consent to have their bunions treated surgically.

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British Medical Association News.

MEETING OF THE FEDERAL COUNCIL.

A MEETING OF THE FEDERAL COUNCIL OF THE BRITISH MEDICAL ASSOCIATION IN AUSTRALIA was held at the University of Tasmania, Hobart, on January 15, 1934, SIR HENRY NEWLAND, the President, in the chair.

Representatives.

The following representatives of the Branches were present:

New South Wales: Dr. George Bell, O.B.E., Dr. A. W. Holmes à Court (as substitute for Dr. J. Adam Dick).
Queensland: Dr. D. G. Croll, C.B.E., Dr. E. S. Meyers.
South Australia: Sir Henry Newland, C.B.E., D.S.O., Dr. Bronte Smeaton.
Tasmania: Dr. A. W. Shugg, Dr. S. Gibson.
Victoria: Dr. J. Newman Morris.

Dr. J. Newman Morris acted as proxy for Dr. F. L. Davies, of the Victorian Branch.

Minutes.

The minutes of the previous meeting of the Federal Council of August 28, 1933, were read and signed as correct.

Appointment of President and Vice-President.

It was resolved, on the motion of Dr. George Bell, seconded by Dr. Bronte Smeaton, that Sir Henry Newland be appointed President and Dr. J. Newman Morris Vice-President of the Federal Council for the ensuing twelve months.

Appointment of Honorary Treasurer.

It was resolved, on the motion of Dr. A. W. Shugg, seconded by Dr. Bronte Smeaton, that Dr. J. Adam Dick be appointed Honorary Treasurer of the Federal Council for the ensuing twelve months.

Appointment of General Secretary.

At the last meeting of the Federal Council discussion took place regarding the appointment of a general secretary to the Federal Council. Sir Henry Newland and Dr. Bronte Smeaton were appointed a subcommittee to draw up the conditions of the appointment and to report to the next meeting. Sir Henry Newland and Dr. Bronte Smeaton presented their report as follows:

1. Applications shall be invited by advertisement in THE MEDICAL JOURNAL OF AUSTRALIA.
2. The applicant must be a duly qualified medical practitioner.
3. The post shall be a part-time appointment.
4. The term of appointment shall be three years.
5. The salary shall be at the rate of £150 *per annum* and subject to revisal should the holder of the appointment be reappointed.
6. Clerical assistance shall be continued on the existing scale.
7. The Secretary shall be responsible for: (*a*) the keeping of the minutes, (*b*) all correspondence and all filing, (*c*) keeping the books, (*d*) all such duties as the Council may from time to time determine.

The report of the subcommittee was adopted.

Financial Statements.

The financial statements of the Federal Council for the six months ended December 31, 1933, prepared and audited by Messrs. Coates, Cunningham and Company, Chartered Accountants, together with the Australasian Medical Congress (British Medical Association) accumulated funds account, were presented and adopted.

Contribution from the Branches.

Discussion took place on the amount of the contribution to be levied on the Branches. It was pointed out that the Federal Council had power to levy a contribution of two shillings *per annum* per member. This sum had not always been asked for. Sometimes the funds of the Federal Committee had been ample and no contribution had been levied on the Branches. Dr. C. H. E. Lawes, the General Secretary, read a statement from the Honorary Treasurer, Dr. J. Adam Dick, who was not able to be present at the meeting. In this statement Dr. Dick pointed out that the credit balance of the Federal Council was not very large and that there was likely to be a heavy drain on the funds in the future, especially in connexion with the annual meeting of the British Medical Association to be held in Melbourne in 1935, when most of the members of the Federal Council would be likely to attend a meeting of the Council in Melbourne.

It was resolved, on the motion of Dr. Bronte Smeaton, seconded by Dr. George Bell, that the sum of two shillings per member be asked for from the Branches for 1934.

Expenses of Members of the Federal Council.

The Secretary read some correspondence that he had had with the President regarding the expenses of members of the Federal Council who were also members of the Australasian Medical Publishing Company, Limited. It was pointed out that in the past half the travelling expenses and half the allowance of members of the Federal Committee who were also members of the Australasian Medical Publishing Company, Limited, had been paid by the Publishing Company. Under the rules of the Federal Council, the Council was required to pay the whole of the expenses. The Secretary reported that the Publishing Company had offered to pay half the daily allowance of those who were members of both bodies when attending statutory meetings of the Company. It was resolved that the offer of the Australasian Medical Publishing Company, Limited, be accepted with thanks.

The Seal of the Federal Council.

At the last meeting of the Federal Council, Dr. C. H. E. Lawes, Dr. J. Adam Dick and Dr. George Bell were appointed a subcommittee to obtain an embossing seal for the Federal Council. Dr. Lawes reported that a seal had been obtained, and he passed round an imprint of the seal for inspection. The action of the subcommittee was approved.

Executive Committee.

The question of the appointment of an executive committee of the Federal Council, in accordance with Article 13, which had been discussed at the previous meeting, was again discussed. Several members expressed the opinion that the time was not ripe for the appointment of an executive committee. An executive committee would consist of six members. It was resolved, on the motion of Dr. Bronte Smeaton, seconded by Dr. J. Newman Morris, that consideration of the appointment of an executive committee be deferred.

Medical Officers' Relief Fund (Federal).

The Secretary reported that the deed of appointment of the new trustees of the Medical Officers' Relief Fund (Federal) had been signed and the new trustees had been registered. The trustees were Dr. George Bell, Dr. J. Adam Dick and Dr. G. C. Willcocks.

Poliomyelitis.

At the meeting of the Federal Committee in February, 1932, attention was drawn to the investigations being made by Dr. Jean Macnamara into poliomyelitis. It was decided at that meeting to ask Dr. Macnamara to submit to the Federal Committee a report of her findings. The Secretary reported that Dr. Macnamara had forwarded her report. On the motion of Dr. E. S. Meyers, seconded by Dr. A. W. Shugg, the report was received and it was resolved that Dr. Macnamara be thanked for her services.

A subcommittee consisting of Sir Henry Newland and Dr. A. W. Shugg was appointed with power to act in regard to any matters contained in the report that might need attention before the next meeting of the Federal Council.

Resignation of Dr. Gregory Sprott from the Federal Council.

The Secretary said that he had received the resignation of Dr. Gregory Sprott from the Federal Council. Sir Henry Newland pointed out that Dr. Sprott had been a member of the Federal Committee from 1914 until it was superseded by the Federal Council; he had also been a member of the Federal Council. Sir Henry Newland moved that a letter of appreciation of his long services be sent to Dr. Sprott. The motion was seconded by Dr. S. Gibson and carried unanimously.

A "Representative Body" in Australia.

At the last meeting of the Federal Council a discussion took place on the desirability of forming in Australia a body analogous to the Representative Body of the Association in Great Britain, which might discuss medico-political matters affecting the Branches as a whole. At that meeting a scheme was to have been placed before the Federal Council by Dr. E. S. Meyers and Dr. D. G. Croll. Dr. Meyers and Dr. Croll, however, did not present a report and consideration of the question was deferred until a report should be submitted.

Dr. Meyers and Dr. Croll submitted a report which included a draft constitution of a proposed federal convocation of the British Medical Association in Australia. The draft was a complete scheme of the proposed body—the objects, membership, management, and so forth were fully stated. The report was received.

Dr. J. Newman Morris said that at present all the members of the Federal Council could inform themselves of the views of their Branches before they came to the Council meetings. The new convocation would do no more than the Federal Council was doing. Any resolutions adopted by such a body as a convocation would be informative only. A convocation would, he thought, only add to their difficulties.

Dr. A. W. Shugg said that there was justification for such a body, even if it could not act. At the same time he thought that the situation would be met if full sessions of congresses were held for the discussion of important matters. He referred to the discussion on hospital problems to be held at the Fourth Session of Congress.

Dr. Bronte Smeaton thought that a convocation would be a duplication and was therefore unnecessary.

Dr. George Bell viewed with apprehension the matter of finance of such a body as a convocation. He agreed with Dr. Shugg that discussions on important matters might be held at full sessions of congresses.

Dr. E. S. Meyers thought that the proposal should go to the Branches before it was scrapped. He referred to a letter written in 1912 by Sir Henry Newland, in which the formation of a Federal Committee was mentioned, as well as the formation of a "representative body".

Sir Henry Newland explained that the letter mentioned by Dr. Meyers was written before there was such a body as the Federal Council. The formation of the Federal Council had, in his opinion, made the setting up of a convocation unnecessary. He thought that general matters of interest could be debated at congresses.

A motion for the approval of the draft as submitted by Dr. Meyers and Dr. Croll was put to the meeting and lost.

Dr. J. Newman Morris moved:

> That discussion of matters of common interest amongst members of the British Medical Association during the holding of congresses has served a useful purpose. The Federal Council will endeavour to provide opportunities for such discussions at all future congresses.

The motion was seconded by Dr. E. S. Meyers and carried.

Australasian Medical Congress (British Medical Association).

Proposed Session in Perth.

The Secretary presented a statement of receipts and expenditure from the Executive Committee appointed in Western Australia in connexion with the proposed session of congress in Perth. The statement was received and adopted.

Fourth Session.

The list of honorary members of the Fourth Session of Congress submitted by the Executive Committee was approved.

Fifth Session.

Consideration of the date and place of meeting of the Fifth Session of Congress was deferred until the next meeting of the Federal Council.

Attention was drawn by several members to certain defects in the constitution and regulations of Congress. It was determined that the regulations should be revised. Dr. George Bell, Dr. J. Adam Dick and the Secretary, Dr. C. H. E. Lawes, were appointed a subcommittee to consider the matter and to bring forward suggestions to the next meeting of the Federal Council.

Federal Health Services.

At the last meeting of the Federal Council and at the final meeting of the Federal Committee consideration was given to the public health administration in tropical Australia. At the final meeting of the Federal Committee it was resolved that the Commonwealth Government should be urged to reestablish the Division of Tropical Hygiene or to institute an efficient substitute for it. At the last meeting of the Federal Council a letter was read from the Minister of Health, and members had before them a copy of *Health*, in which the activities of the Commonwealth Department of Health in tropical hygiene were set out. After the last meeting of the Federal Council the members of the Council had an opportunity of inspecting the School of Public Health and Tropical Medicine at the University of Sydney.

After discussion it was resolved, on the motion of Dr. D. G. Croll, seconded by Dr. J. Newman Morris, that a letter be sent to the Minister for Health for the Commonwealth stating that the Federal Council was concerned not with the success or failure of the local medical services existing in Papua and the Mandated Territory of New

Guinea or in the Northern Territory, but that it was particularly concerned that the broader national issue should not be entirely overlooked. It was to be stated that the Federal Council felt sure that the vital importance of tropical hygiene deserved special attention in order that an effective general policy throughout the whole of tropical Australia and its island dependencies might be thereby established. It was to be pointed out that as the Federal Council understood the position, the Commonwealth Department of Health had only an advisory relationship to health matters in the island territories, and it urged that the Department should have closer administrative control. The Federal Council realized the difficult financial position in which the Federal Government had been working, but it anticipated that effective organization would be created and that essential work would be carried out.

A Hospital Policy for Australia.

At the last meeting of the Federal Council the formulation of a hospital policy for the British Medical Association in Australia was considered. At the last meeting of the Federal Committee, Dr. D. G. Croll and Dr. E. S. Meyers were appointed a subcommittee to draw up a report on the matter for submission to the Federal Council. At the last meeting of the Federal Council, Dr. Croll and Dr. Meyers presented an interim report, and the Federal Council resolved that if the Executive Committee of the Fourth Session of Congress could make the necessary arrangements, opportunity should be given for selected representatives of the Branches to discuss hospital problems. It was noted that at the Fourth Session a full meeting of Congress would discuss the subject. Sir Henry Newland pointed out that the members of the Federal Council should understand how the present position had arisen. He said that it had not originally been intended that the discussion should be one of the full congress, but that only selected representatives should take part. At the same time he said that the Executive Committee of Congress had power to put on the agenda paper any matter that it thought fit. Correspondence between the joint Honorary Secretaries of Congress and Sir Henry Newland was read. The correspondence was received.

Dr. E. S. Meyers pointed out that the subcommittee of the Federal Council would probably derive considerable assistance from the discussion at the plenary session of Congress.

An Insurance Contributory Scheme.

Mention was made of the arrangements entered into by several of the Branches of the British Medical Association in Australia with the Colonial Mutual Life Insurance Company regarding an insurance contributory scheme. A letter was received from the South Australian Branch requesting that steps be taken to secure uniformity of the agreement between the Company and the Branches in the several States. After discussion it was decided that the South Australian Branch should be informed that as far as the Federal Council could discover the conditions in the several States were uniform.

Repatriation Department.

The agreement entered into between the Federal Committee and the Repatriation Department regarding the medical treatment of widows and orphans of soldiers whose death was due to war service, and of widowed mothers of such deceased unmarried soldiers, was considered at the last meeting of the Federal Council. This arrangement was made in 1924, and, according to the terms of the agreement, the members of the medical profession had undertaken to treat these widows and orphans through the friendly societies at the rates and under the conditions obtaining in each district. Since 1924 further names had been added to the list, and the Federal Council held that this was not in accordance with the original agreement. At the last meeting of the Federal Council it was resolved that a letter should be sent to the Repatriation Commission setting out the views of the Council on the matter. Some correspondence from the Repatriation Commission was read, and the General Secretary, Dr. C. H. E. Lawes, reported the result of an interview with the Department of Repatriation in New South Wales. The Department held that it was never intended that the original list should be final; that if, for example, a man died as a result of war injuries ten years after the war, his wife might elect to go on the list, provided she had been his wife when he returned from the war.

Dr. J. Newman Morris insisted that there was no intention to add new names to the list. The arrangement referred only to men who were deceased at the time the agreement was made, and that if new names were to be added a fresh agreement should be made.

Dr. Bronte Smeaton said that the arrangement was a bad one and should be revised.

Dr. D. G. Croll pointed out that under the terms of the agreement the members of the medical profession were helping the Repatriation Department—they were providing treatment which the Repatriation Department was compelled to give.

It was resolved that Dr. J. Newman Morris and Dr. F. L. Davies should see the Commissioner in Melbourne and, if necessary, intimate that the Federal Council was contemplating the termination of the present agreement.

The Naval Medical Services.

Further reference was made to the disabilities under which medical officers of the Royal Australian Navy worked. This matter had been before the last meeting of the Federal Council and before several meetings of the Federal Committee. It was pointed out that since the last meeting of the Federal Council the Warren Fisher report had been issued in England and had been published in summary in *The British Medical Journal* of October 28, 1933. A letter, approved by the President, Sir Henry Newland, containing a summary of the Warren Fisher report, had been sent to the Minister for Defence in November, 1933. Only a formal acknowledgement had been sent by the Minister. During discussion it was stated that the Admiralty had not yet dealt with the Warren Fisher report and that this would probably take some time. It was resolved that a further letter be sent to the Minister regarding the Warren Fisher report and that emphasis be laid on the increased disadvantages of medical officers in the Royal Australian Navy and on the few advantages that they had.

The Federal Health Council.

At the last meeting of the Federal Council a resolution was adopted to the effect that the Federal Council should be allowed to nominate representatives to be appointed by the Federal Government to act on the Federal Health Council, as recommended by the Royal Commission on Health in 1925. The General Secretary reported that a letter had been written to the Minister and that he had replied suggesting that closer cooperation could be effected between the several Branches and the State departments of health. At the same time the Minister asked the Federal Council to set out the advantages that it thought would follow the appointment of representatives to the Federal Health Council. It was resolved that a copy of the Minister's letter be sent to each Branch and that suggestions should be invited. It was also decided that the matter should be left in the hands of Dr. E. S. Meyers and Dr. D. G. Croll as a subcommittee to report to the next meeting of the Federal Council.

"Who's Who in Australia."

Further reference was made to the propriety of members of the Branches supplying information to the editor of "Who's Who in Australia". The General Secretary read letters from all the Branches setting out their views. Some of the Branches were in favour of members being allowed to supply information and others were opposed to it. It was pointed out that the Queensland Branch

offered no objection, provided the information supplied was first of all submitted to the Branch Council for approval. On the motion of Dr. Bronte Smeaton, seconded by Dr. D. G. Croll, it was resolved, Dr. Bell and Dr. Holmes à Court dissenting, that the Branches be informed that particulars might be submitted to the editor of "Who's Who in Australia", provided that they were first of all submitted to the Branch Council of the State in which the member resided.

The Policy of the Federal Council.

A communication was received from the Queensland Branch asking the Federal Council to reaffirm as its policy the policy of the Federal Committee. It was resolved, on the motion of Dr. E. S. Meyers, seconded by Dr. D. G. Croll:

> That the Federal Council reaffirms the policy of the Federal Committee in regard to activities that have so far failed to produce results and that the Federal Council states the methods it intends to follow to give effect to such policy in regard to such matters as the formation of a medical research council and the recommendation of the Royal Commission on Health in regard to tropical hygiene.

The motion was carried.

The Broadcasting of Health Talks.

At the previous meeting of the Federal Council it was resolved that the health authorities be asked to restrict wireless lectures on health to legally qualified medical practitioners or to other persons approved by the health department in each State. The General Secretary reported that he had received a letter from the Director-General of the Postmaster-General's Department asking for specific instances of broadcasts which the Council considered misleading and harmful. It was resolved that a letter be sent to the Director-General of the Postal Services to the effect that the Federal Council was not prepared to give specific instances as requested, but reiterated its previous request.

Confidential Information and Insurance Companies.

A letter was received from the Queensland Branch asking the Federal Council to reconsider the resolution of the Federal Committee of August, 1926. Enclosed with this letter were copies of some correspondence with a member of the Queensland Branch setting out reasons why the matter should be reconsidered. It was decided to reopen the question. After some discussion it was resolved, on the motion of Dr. E. S. Meyers, seconded by Dr. S. Gibson, that legal advice should be obtained on the matter.

Possible Influx of European Practitioners into Australia.

Further reference was made to the possible influx of European practitioners into Australia owing to disturbed conditions on the Continent of Europe. The General Secretary reported that a letter had been sent to all the Branches asking them to bring the matter before the Medical Board of the State. After discussion it was resolved, on the motion of Dr. A. W. Holmes à Court, seconded by Dr. George Bell:

> That in view of the adequate supply of medical practitioners who are graduates of British universities, it is undesirable to admit graduates of alien countries unless reciprocity of registration exists with those countries.

Sales Tax Exemptions.

A letter was read from the Victorian Branch in regard to the sales tax exemptions for drugs and medicines. It was pointed out that the question had been raised as to whether medicaments used for external application came into this category. The Victorian Branch held that they did. It was resolved that the view of the Victorian Branch be endorsed.

Medical Service in Nauru.

It was noted with satisfaction that a considerable improvement in the conditions of medical service in Nauru had been made.

Next Meeting of the Federal Council.

It was resolved that the date and place of the next meeting should be left in the hands of the President.

Votes of Thanks.

Votes of thanks were accorded to the President and Council of the Tasmanian Branch for their hospitality, to the University of Tasmania for having provided accommodation for the meeting, and to the President, Sir Henry Newland, for having presided.

SCIENTIFIC.

A MEETING OF THE NEW SOUTH WALES BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held on November 30, 1933, in the Robert H. Todd Assembly Hall, British Medical Association House, 135, Macquarie Street, Sydney, DR. A. HOLMES À COURT, the President, in the chair.

Empyema.

DR. R. B. WADE read a paper entitled: "The Surgical Treatment of Empyema" (see page 175).

DR. H. S. STACY read a paper entitled: "The Treatment of Empyema" (see page 178).

DR. RICHARD FLYNN thanked the speakers for their very interesting lectures, which covered all the important aspects of empyema. He thought that Dr. Stacy had hit the nail on the head in referring to the value of the work done by the American Commission on Empyema. Dr. Flynn referred to the high mortality in influenza epidemics on account of the complicating empyema.

One of the first cases with which he had to deal was one of empyema. A rib was resected under local anæsthesia, but the lung was not adherent and the patient died. He then concerned himself with methods that he thought might help to prevent a recurrence of this tragedy. He said that these patients were ill; often their hearts were carrying their full load and the interference (though necessary on account of both mechanical obstruction and toxic absorption) must be minimal. What was wanted was something that would be the equivalent of repeated aspirations and yet without the risk of rib resection. He first commenced with an old Kelly female cystoscope and a catheter which fitted tightly. He used local anæsthesia and took care that the parietal pleura was rendered anæsthetic, for while a resident at the Royal Prince Alfred Hospital he had seen a patient fall back dead on insertion of an aspirating syringe. A small incision was made in the skin and the cystoscope was forced through. The trochar was removed and the catheter inserted. Owing to the bore of the cystoscope and the catheter being the same, the elasticity of the tissues caused them to grip the catheter tightly so that there was no pus leakage and no air entry. He performed this little operation in bed with no more difficulty and no more discomfort to the patient than was caused by the insertion of the usual aspirating cannula. The result in the first patient treated in this way was good, as it was in several others treated in the same way. Dr. Flynn then tried to improve on this method and contrived an apparatus that he demonstrated to the meeting. (He stressed the importance of first aspirating the chest to confirm the diagnosis.) He stated that, briefly, the apparatus consisted of a cannula and two inner pieces, the centre one of which acted as a trochar. This, although it looked formidable, could easily be inserted between two ribs by using a gentle rotary motion, corkscrew-like. There was a tap on the cannula that could be closed after the trochar was removed to prevent air entry while the surgeon picked up the catheter. He said that an ordinary straight catheter could be used, but

that he preferred to use Pousson's catheter (both size 28), because, on account of its curl, it possessed the same advantages as the inner flange of Tudor Edwards's tube, namely, it did not tend to pull out easily and there were already four holes in it, so that if one became stopped up with fibrin, aspiration might still go on; but blockage was rare because of the method of after-treatment. If a Pousson's catheter was used, it had to be threaded over an inserter, and to insure easy manipulation both catheter and inserter were lubricated with sterile paraffin oil. He further stated that the catheter should be marked so that the surgeon might know for certain when the innermost hole of the catheter was inside the pleural cavity, for if this was left in the thoracic wall it might lead to cellulitis. The cannula then could be easily slipped out over the catheter. To fix the catheter he used a rubber collar similar to those used on suprapubic catheters in drainage of the bladder, and this could be strapped on to the thoracic wall. If vaseline roll gauze were rolled around the catheter, it protected the skin from pressure and infection and also was a second defence against air entry. To prevent the catheter being pulled out, he greatly deprecated the use of a safety pin through the catheter, and said that he always put a few turns of adhesive plaster around the catheter and inserted the safety pin through this.

A clamp was now attached to the catheter and so it had been inserted with practically no air entry.

A good type of syringe, one with a ground glass plunger for choice, was now attached to the catheter, the clamp loosened and a syringe full of pus aspirated. The clamp was closed and the syringe emptied and half filled with Dakin's solution, ordinary saline solution or acriflavine, according to the type of pus aspirated, and this was gently inserted through the catheter into the chest. This manipulation could be repeated hourly and the chest gradually emptied, just as an over-distended bladder was gradually emptied, and with as satisfactory results. With this method of drainage the patient was absolutely free in bed, and it thus possessed an advantage over Dr. Stacy's complicated system and, he thought, with less risk of a complicating osteomyelitis of the resected ribs.

Dr. Flynn said that he had treated over a dozen patients in this way and that the condition had cleared up entirely (this was the streptococcal type). In the pneumococcal type, when fibrin was present, a rib could, if necessary, be resected afterwards. In conclusion, Dr. Flynn mentioned lung abscess and its rupture into the pleural cavity.

DR. GEORGE BELL congratulated the readers on their very excellent papers, which left not a great deal to say. Much that he would say would confirm their remarks. Dr. Bell was very glad to hear the speakers deprecate the early operation on patients with streptococcal infection that had been previously recommended. Anyone who had had experience of streptococcal infections following upon gunshot wounds realized the fatal results of early opening. At the war they had learned to respect the power of the pleura to resist infection more than in the past. Dr. Bell had worked in France with Adrian Stokes, of Dublin. Dr. Stokes examined the material aspirated from the pleura and found gas-forming organisms as well as streptococci. Many of these infections healed with repeated aspiration. These conditions admittedly were different from ordinary post-pneumococcal empyemata. The lung in gunshot wounds was not affected by such extensive inflammation as in pneumonia. Older practitioners had told him that many post-pneumonic empyemata had recovered with aspiration. Possibly Dr. Abbott could tell them more about this. Closed drainage presented an advance, particularly in streptococcal cases. Dr. Wade, however, had pointed out that when there was much fibrin, the cavity must be cleared out; they could then continue with the method advocated by Dr. Stacy and Dr. Flynn. If this were not done the cavity might later be prevented from closing by dense adhesions over the lungs. It was very dramatic in some cases, in which a cavity persisted, to divide under local anæsthesia thick bands of pleura, then to get the patient to hold his nose and take a deep breath; one could see the expansion of the lung and the filling of the cavity. Dr. Bell said that he could support Dr. Wade in what he said concerning decortication of the lung. He referred to the case of a man with a chronic cavity, from whom he had removed ribs and thickened parietal pleura. The patient was doing well when he took an overdose of alcohol and disappeared from hospital. Dr. Bell saw him a year later and removed portion of the visceral pleura which was as thick as bullock hide. There was much free bleeding, but the wound eventually healed. In these cases local anæsthesia was a distinct advantage.

In regard to methods of closed drainage, Dr. Bell thought that Dr. Flynn's method was a good one. The Tudor Edwards tube was not without its dangers, even though the internal flange and tube were made in one piece; if the rubber perished it was likely to be dangerous. One method of drainage that was also dangerous was the "cigarette drain" of rubber. Dr. Bell quoted the case of a man with a chronic sinus in the chest that had persisted for some years. He had been under the impression that the man had been at the war and that the sinus had resulted from a war injury. But it appeared that while in a training camp the man had contracted pneumonia and empyema. He had been treated with "cigarette" drainage. Sir Alexander MacCormick saw the patient and suggested that the cavity should be opened freely. After making a free excision of ribs Dr. Bell followed the sinus through the base of the right lung as far as the pericardium. He then put in a blunt curette and extracted half an inch of the end of this rubber "cigarette" drain.

DR. G. H. ABBOTT said that he became a resident medical officer at the Royal Prince Alfred Hospital a few months before he gained his degree, and began operations on empyema at that time. If an honorary physician found an operation on an empyema to be necessary, he said: "Let the house surgeon do it"; and the results were usually good, because the chest was opened at the right time—neither too early nor too late. What caused the bad cases was leaving them too long. In regard to the question that Dr. Bell asked him, it was a fact that a few of the patients did seem to be cured after repeated aspirations. Sometimes, in cases too bad for a general anæsthetic, an incision was made between two ribs with the aid of a local anæsthetic and those patients usually did well. Sir Alexander MacCormick often made an incision between two ribs, inserted an ordinary sound and made a counter-incision over its end, which had been pressed down to the most dependent part of the cavity. The empyema was dangerous if it communicated with a bronchus and if, during operation, the patient were turned on to his sound side; the patient would be likely to be drowned by his own pus. In opening an empyema, it was wise to get the patient to the side of the operation table so that there was no need to turn him on his sound side. The anæsthetic, if a general one, should be light, and the pus should be allowed to escape slowly.

DR. D. G. MAITLAND remarked that very little had been said on the X ray side of empyema of the chest. The radiologist could not differentiate between the shadow cast by pus, blood and ordinary pleural effusion in the chest. But he could, with a series of films, watch the process of development of an empyema and give an idea of the position of the exudate and of the best point for resection or aspiration. Speaking of chronic empyema cavities, Dr. Maitland said that since 1929 he had seen quite a number of old chronic empyemata examined by X rays. In about thirty of these the cavities had been outlined by lipiodol or pyelographic material, and it was considered a routine procedure in many overseas hospitals. It was possible to outline the extent of a cavity and the loculi of a chronic empyema by radiography with the patient in the erect antero-posterior and true lateral positions, and also in the prone position after injection of the opaque solution. With the patient lying down they could determine the length and breadth, while a lateral view would show the third dimension of the cavity. As opposed to the old method of exploratory needling in acute cases, the taking of an X ray picture often saved time and trouble to the physician and inconvenience to the patient.

DR. V. M. COPPLESON congratulated the speakers on their able papers. First, in reference to what Dr. Maitland had said, Dr. Coppleson thought that X ray pictures were of value in diagnosis and also in prognosis. If in the picture the empyema was seen to be below the lung, then the prognosis was good, and if the lung was collapsed against the hilum, as frequently occurred in streptococcal empyema, then the prognosis was bad.

In regard to closed drainage, Dr. Coppleson would have liked Dr. Wade and Dr. Stacy to have quoted figures in support of the method they advocated. When Tudor Edwards's paper had appeared, Dr. Coppleson considered the question of the adoption of closed as against open drainage. The literature since then had been much in favour of closed drainage. Yet the surgeon often had to resort to open drainage later. Dr. Coppleson had not yet adopted closed drainage, for three reasons: (i) The method appeared to be based on a misconception, since it predicated that there was merely a simple cavity to be drained; in empyema this was not always so, since adhesions had to be considered. By exploring the pleural cavity it was often found that two tubes were needed to drain two communicating cavities. (ii) It implied that closed drainage resulted in expansion of the lung. This had yet to be proved. (iii) It seemed difficult to obtain absolute closed drainage; if the closure were too tight sloughing took place, and if it were not so tight pus tended to escape at the side of the tube.

In streptococcal empyema it was difficult to get the mortality down. It was unnerving to both the patient and the operator to pass needles repeatedly and to aspirate frequently, especially when, in spite of these measures, the patient was seriously ill and running a hectic temperature. Further, cellulitis not infrequently supervened at the site of puncture. Dr. Coppleson thought that it was doubtful whether all that had been claimed for closed drainage could be substantiated, although it was probable that in certain cases it might prove a distinct advance on other methods.

DR. COTTER HARVEY congratulated the readers of the papers; they had thoroughly covered the whole field of treatment. To the physician fell the lot of diagnosis, and this was not nearly as simple a matter as it was, say, fifteen years ago.

As the principal speakers had so well shown, it was necessary in making a diagnosis to decide whether the empyema was syn-pneumonic or meta-pneumonic, whether the infection was pneumococcal, streptococcal or due to some other organism. There were matters for the physician to decide before calling the surgeon to his aid. Empyema was a serious malady, with a mortality of 25% for adults and much greater for children, ranging up to probably 75% in children under two years of age. It should not be forgotten, however, that an important factor was the individual's resistance to infection. Some patients would certainly recover, whatever method of treatment was employed, while in others it was apparent from the outset that the patient was overwhelmed by his infection and was doomed. Dr. Wade stated that without proper treatment the patient would die. This might be true in children, but in adults a small empyema could undoubtedly become inspissated and complete healing occur without drainage. He could recall at the moment five cases in which the presence of the empyema had been missed and the patient had carried pus in his chest for several months with comparatively little discomfort. It was at times advisable to aspirate, even in pneumococcal infection, if there was considerable mediastinal displacement. Operation might increase cardiac embarrassment and prove to be the last straw. If correctly carried out, aspiration was not at all painful.

Though the need for delay in operation in streptococcal cases had been adequately discussed, in that adhesions formed, the vital point had not been made that thereby the mediastinum became fixed by adhesions and mediastinal flutter was prevented. Dr. Harvey suggested that aspiration should be done more often.

Dr. Harvey referred to his association with Dr. Coppleson at the Royal North Shore Hospital of Sydney. In Dr. Coppleson's hands the results with open drainage were good. But he himself leaned towards closed drainage and thought that with this method convalescence was shorter.

Tuberculous empyema was practically always a fatal complication. It was agreed that in this open drainage was fatal, but he had notes of several patients in whom a sinus had formed after aspiration and who had survived for several years. In one the sinus healed completely. He was not certain what was the best treatment, whether it should be simple aspiration or combined with pleural lavage or with gas replacement; thoracoplasty had been employed with occasional success. Dr. Harvey would like to hear the opinion of members concerning interlobar empyema. This condition was difficult to diagnose and to locate. He thought that it undoubtedly originated in a pulmonary abscess. He questioned if it was advisable to keep on needling or to do a thoracotomy in an endeavour to find pus, as many patients eventually coughed the pus up. Probably the treatment was as for lung abscess.

Dr. Harvey was in sympathy with Dr. Wade in what he said about blowing into bottles. Their main value appeared to be in keeping the patient amused. As far as inflating the damaged lung was concerned, he thought that with efficient blowing of the bottles a more likely result would be to produce emphysema in the sound lung. Dr. Harvey's practice was to fix the sound side of the chest, as by causing the patient to lean over a chair, and then instituting deep breathing exercises.

Dr. Flynn had mentioned death after aspiration. This was an exceedingly rare complication. He himself had never seen this catastrophe following pleural puncture. The mechanism of this accident was perhaps not yet fully understood. Known as pleural shock, it was generally accepted as being due to vagal inhibition. Dr. Harvey thought that Dr. Flynn's apparatus possessed considerable advantages.

Dr. Wade, in reply, thanked the members for their kindly and courteous reception of his paper. In regard to aspiration, there was no doubt that both in streptococcal and pneumococcal infections cases were reported in which aspiration cured the condition. But it depended on the virulence of the organism *plus* the factor of the resistance of the individual. In some cases the chest had finally to be opened. Dr. Wade referred to the enormous amount of thickening of the pleura that resulted after aspiration. In regard to the question of decortication, when a crucial incision was made through the visceral pleura it was astonishing how the lung would expand. Also there was generally to be found a definite plane of cleavage between the lung and visceral pleura. This could at times be a comparatively easy operation. The mortality was more owing to early operation than to anything else.

Dr. Abbott had raised a point of importance. While Dr. Wade had stressed the mistake of operating too early, Dr. Abbott had stressed that it was equally a mistake to operate too late, owing to the organization of the fibrin in the pleura.

Dr. Coppleson had raised many points that were difficult to answer. There was no actual proof existing that closed drainage expanded the lung, but it almost certainly did allow it to do so with minimum difficulty. His own feeling was that with closed drainage they would get quicker healing. As regards the streptococcal type, it must be remembered that, whatever was done, there would be a large mortality, but if streptococcal cases were dealt with at an early stage by the open method the mortality would certainly be over 80%.

Dr. Wade was glad to hear that Dr. Harvey agreed with him in regard to bottle blowing. He, too, fixed the chest and gave inspiratory exercises.

Dr. Stacy, in reply, referred to what Dr. Flynn had said in regard to fatality from aspirations. He thought death was probably due to pleural shock. If Dakin's solution were injected from a reservoir at too great a height the patient felt faint; this was an example of mild pleural shock.

Dr. Stacy said that his apparatus was not really complicated. The patient was certainly hampered by his connexion with the bottle, but otherwise the method was not complicated and seemed to fulfil its purpose. Dr. Bell had said that the Tudor Edwards tube would no doubt go the same way as the others; he had also said that the flange might come off. This was not possible in the present apparatus, which was made in one piece; it was thus different from the old Pollard tube with its vulcanized flange.

Dr. Abbott had spoken of the old treatment giving good results. The results might be good from the point of view of immediate mortality; but there had been and there still were too many cases of chronic empyema. It was the problem of chronic empyema that had made Dr. Stacy give special attention to the subject, together with the immediate mortality. He had found closed drainage satisfactory in that healing occurred so soon.

Dr. Stacy agreed with Dr. Maitland that the injection of lipiodol *et cetera* had been useful in chronic empyema, but X rays were of doubtful value in acute empyema; he preferred the exploring needle as being less expensive and more accurate. In cases of interlobar empyema X ray pictures would no doubt be of great assistance. Dr. Stacy had had no experience of this condition.

Dr. Coppleson had been very critical of the newer methods. He had a supporter in Hunter, of the King's College Hospital, who, writing in THE MEDICAL JOURNAL OF AUSTRALIA, spoke favourably of open drainage. The results hitherto of open drainage in the hands of most men had not been favourable. Dr. Stacy had not quoted figures to support his views and would not do so if he could, since figures were capable of such manipulation. With the assistance of an intelligent nurse, closed drainage and the Carrell-Dakin treatment gave good results. Dr. Stacy had not found that the tube produced sloughs. In the old type there was difficulty in preventing the air from getting into the pleural cavity. With the added flange and with the additional rubber sheet over the dressing, suction drainage was more accurate. Dr. Stacy remarked that the creation of negative pressure helped the lung to expand.

DR. A. HOLMES A COURT expressed his personal tribute of thanks to the readers of the papers, who had given them the value of their wide experience in dealing with this dangerous disease. He was grateful and appreciative.

NOMINATIONS AND ELECTIONS.

THE undermentioned have been elected members of the Victorian Branch of the British Medical Association:

Ackland, Thomas Harry, M.B., B.S., 1932 (Univ. Melbourne), Melbourne Hospital, Melbourne, C.1.

Alsop, David George, M.B., B.S., 1932 (Univ. Melbourne), Melbourne Hospital, Melbourne, C.1.

Bottomley, Edward Eric, M.B., B.S., 1932 (Univ. Melbourne), Melbourne Hospital, Melbourne, C.1.

Bryan, Francis John, M.B., B.S., 1928 (Univ. Melbourne), 717, Glenhuntly Road, Caulfield.

Clyne, Andrew Jack, M.B., B.S., 1932 (Univ. Melbourne), Melbourne Hospital, Melbourne, C.1.

Hooper, Reginald Smythe, M.B., B.S., 1933 (Univ. Melbourne), Melbourne Hospital, Melbourne, C.1.

Kenny, James William, M.B., B.S., 1931 (Univ. Melbourne), Homœopathic Hospital, Melbourne.

MacColl, Lorna Jean Stewart, M.B., B.S., 1931 (Univ. Melbourne), Queen Victoria Hospital, Melbourne.

Sinclair, Alexander John Maum, M.B., B.S., 1933 (Univ. Melbourne), Alfred Hospital, Prahran, S.1.

Wilson, William Wellesley, M.B., B.S., 1932 (Univ. Melbourne), Alfred Hospital, Prahran, S.1.

Obituary.

MARY JOSEPHINE STACK.

WE regret to announce the death of Dr. Mary Josephine Stack, which occurred on January 28, 1934, at Melbourne, Victoria.

ALFRED GLOVER COOLEY.

WE regret to announce the death of Dr. Alfred Glover Cooley, which occurred on January 30, 1934, at Sydney, New South Wales.

New Medicaments, Apparatus, etc.

In this section attention of readers will be directed to new medicaments, apparatus et cetera referred to in THE MEDICAL JOURNAL OF AUSTRALIA ADVERTISER.

"HEBARAL SODIUM."

"HEBARAL SODIUM" is the sodium salt of hexyl-ethyl-barbituric acid and is a white stable powder readily soluble in water. It is a new preparation put forward by Parke, Davis and Company.

Therapeutic Indications.—"Hebaral Sodium" may be prescribed in all conditions in which a hypnotic and sedative effect is desired, for example, insomnia, mental excitement, including insanity, nausea and vomiting, especially *hyperemesis gravidarum*, nervous headaches and migraine, eclampsia, alcoholism *et cetera*. In the first stages of labour it will produce amnesia. It allays excitement in drug addicts during the withdrawal period. For pre-operative medication it is a useful sedative and decreases the toxicity of cocaine and procaine.

Dose.—The dose of "Hebaral Sodium" must be regulated to suit the individual patient if best results are to follow, as persons vary so greatly in their susceptibility to barbituric acid compounds. While the average dose of "Hebaral Sodium" is 0·2 to 0·4 gramme (three to six grains) (one or two capsules) taken in water, this dose can and should be increased when necessary to produce the desired effect. Further doses may be administered at intervals of two to four hours, according to the condition being treated. Not more than 0·72 gramme (twelve grains) should be administered in the twenty-four hours.

Diary for the Month.

FEB. 13.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
FEB. 20.—New South Wales Branch, B.M.A.: Ethics Committee.
FEB. 22.—South Australian Branch, B.M.A.: Branch.
FEB. 23.—Queensland Branch, B.M.A.: Council.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

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